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Engineering News-Record

Devoted to Civil Engineering and Contracting

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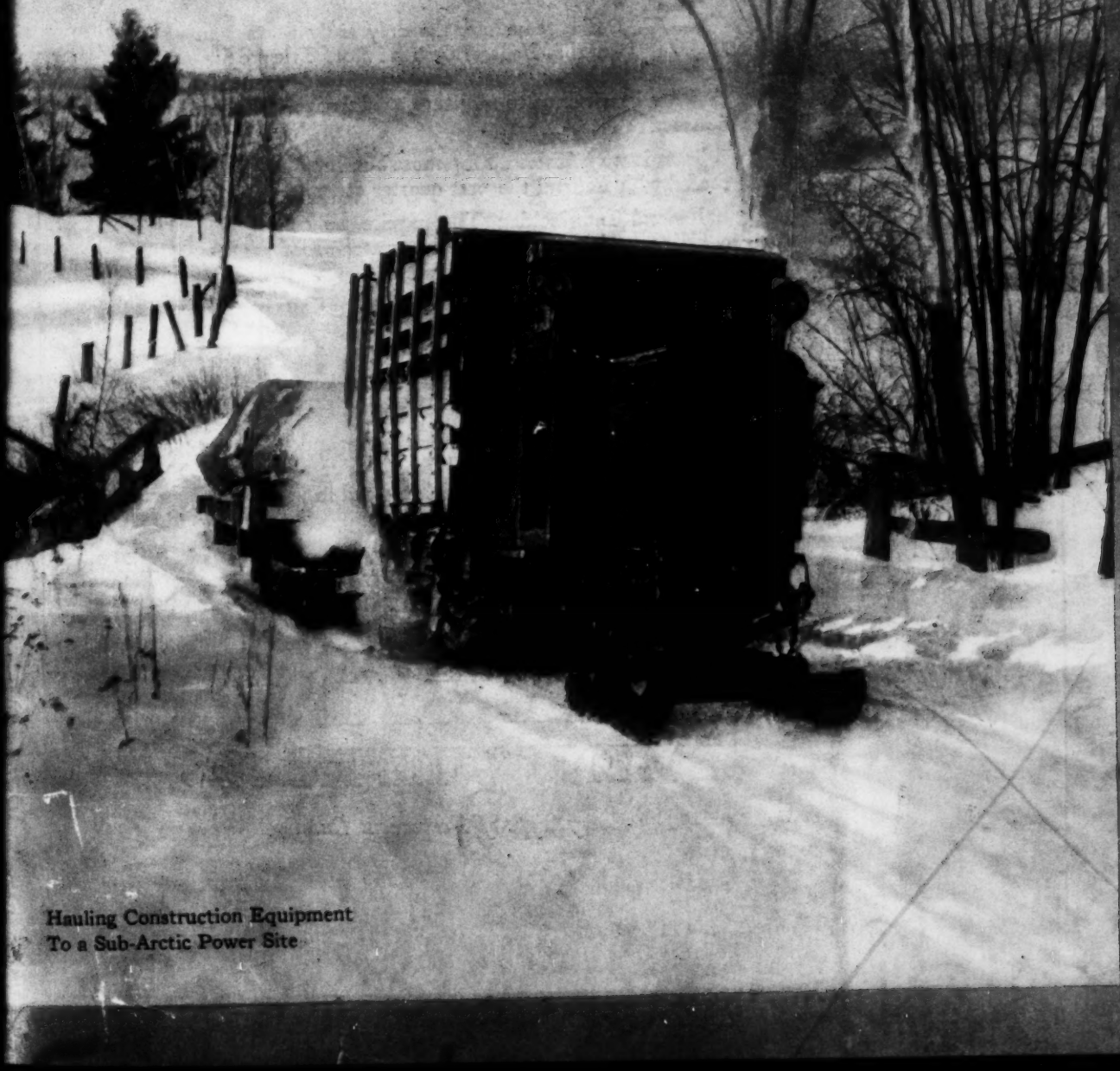

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

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FRANK C. WIGHT
Editor

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A Veteran Passes

COL. Henry G. Prout, who died last week, was one of the last survivors of that great group of engineers whose metal was forged in the Civil War. Like so many of them he left the war young in years but mature in mind and turned to engineering as the best expression of the spirit of action the war had made familiar and necessary. That spirit carried him later into the military and engineering service of the Khedive of Egypt and later still into the then new field of technical journalism, where he converted the physical energy which had characterized his work till then into a mental force which made his paper, the *Railroad Gazette*, a leader in a field where leadership was sorely needed. He was a versatile man, and a wise one. Three years ago for the Fifty-Year Anniversary number of this journal he contributed a brief comment on the development of engineering which deserves reading as a perfect example of the fine co-ordination of thought and expression. "The essence of engineering," he said, "is the seeing eye and the contriving mind." Colonel Prout had those essentials in abundant measure.

Plain Greed

IT APPEARS that although the Boulder Canyon project in every detail is intended for the development of the West and can serve no other purpose, the states concerned are not satisfied with the benefits of this development, even though it is to be done with money furnished by the nation at large. They demand, in addition, that large blocks of power generated at the dam be allotted them by the government for profit. Some of them demand, in addition, the privilege of taxing the development, just as though it were a private enterprise. Going even farther, one or two of the states have demanded the right to levy a royalty on all power produced at the dam. Plain greed is thus taking its place among the forces swirling about the great undertaking. This factor further confuses the issues and renders more difficult a fair consideration of the basic questions on which the decision for or against the project should turn. On the other hand, one fact is made more clear, namely, that the Colorado River states, which have everything to gain through the passage of the Boulder Canyon bill, are jeopardizing their own vital interests through their demands. Ward politics in Congress have rarely made a sorrier showing.

Eliminating the Dealer

CO-OPERATIVE purchasing has always had a great appeal. The spread between manufacturer and consumer is so great in most goods that the service of the middleman seems to be greatly overpaid and many schemes have been developed whereby that service, and the pay therefor, is eliminated. Just now the lure of direct purchasing is attracting the Associated General Contractors and at the meeting at Asheville last week considerable time was devoted to the possibilities of a plan whereby the members of local chapters could combine their purchasing of supplies and equipment. The contractors would do well to go slow on such a scheme, for it presents for their kind of business a number of difficulties. Not the least of these will be the reluctance of the manufacturer to forego his appeal to the individual contractor and the reluctance of the contractor to forego his choice of manufacturer, but even assuming these can be overcome the plan implies the elimination of the supply and equipment agent or dealer, and in the contracting business this middleman has a very real place. Those contractors who contemplate collective purchasing may well consider whether they will be willing to do without the services, of supply and sometimes of financing, that the dealer can give.

St. Lawrence Canal Justified

ESTIMATES of the Department of Commerce for the potential traffic in the proposed ship canal to give the Great Lakes an outlet to the ocean have just been made public (see p. 208 of this issue). Briefly summarized, they show a decided saving in export and import freight rates by the construction of the St. Lawrence ship canal, a lesser saving through the Lake Ontario-to-Hudson canal, and practically no saving through the needless addition to the latter route of a canal around Niagara Falls in order to have an "All-American canal." The calculated savings, however, are based on the assumption that *all* the traffic which could conveniently move to and from the lake region by way of either canal route would move that way. Also, the figures are based on the department's optimistic estimates of water rates as against actual railroad rates. Most of the tonnages that would move by the new water routes would have to be hauled to and from lake ports by rail and thus would be subject to a combined rail and water rate. Naturally, the railroad company which now moves the same freight to and from Atlantic ports will not be inclined to make favorable rates for the shorter haul. Also, they will be inclined to reduce rates to Atlantic ports to meet the new competition. On the other hand, there is reason to believe that the water rate by the ship canal route would not be as favorable as the department's experts estimate. Increases in operating costs and in time of travel have been included in their figures, but they have not included anything for increased overhead cost for ocean transport companies which will be compelled by the change to maintain terminals at both ocean and lake ports nor for possible losses due to lack of return cargo. Neverthe-

less, allowing for the possibility of less freight moving by the ship canal route than the Department of Commerce estimates and for higher water rates than their experts have figured, changes which practically eliminate the Lake-to-Hudson canal, it can safely be said that the Department of Commerce has presented figures which justify the construction of the St. Lawrence ship canal as an economic proposition.

Another Field for Sewage Research

HOW much remains to be done in sewage research is illustrated by Mr. Wolman's notes elsewhere in this issue on the part iron may play in the efficiency of the activated-sludge process, particularly in utilizing a larger percentage of the oxygen introduced. It will be a surprise to many that research bearing on this subject has already been conducted in Germany, Russia, Canada and the United States. Although Mr. Wolman calls "fragmentary" the results presented in his article they are stimulating and should promote further research. This is all the more desirable because the activated-sludge process promises so much in many ways and because its use would be facilitated by a material increase in air efficiency.

Bond Budgeting

BOND budgeting for both municipal and state improvements is on the increase. A few years ago the voters of St. Louis, Mo., adopted a program for the issuance of $87,000,000 of bonds for a long list of public improvements drawn up by a special citizens' committee, the work to be done during a period of some years. Other cities have done the same. Last year New York State followed suit on a large scale. A similar program is now being framed at Dallas, Tex., by a citizens' advisory committee. This is in commendably marked contrast with the usual piecemeal, haphazard bonding methods of American cities. It means relatively long looks ahead and the weighing and balancing of all the many public needs constantly pressing for money and final scheduling more in accordance with relative merit and urgency than is possible when each project is presented singly.

Street Lighting and City Planning

THE street lighting engineer is now a strong advocate of city planning. In this he stands with water-works, fire prevention, sewerage, paving, telephone, transportation and other engineers. In common with all these the lighting engineer has to design works to meet the city needs of the future as well as of the present and with them he is constantly embarrassed by the almost universal past neglect of city authorities to plan for the future of the city as a whole, if indeed they have planned adequately for any one branch of the municipal service. Latterly, city zoning has come to the aid of the engineering specialist in nearly all municipal fields. This has been brought out as regards water-works, sewerage and paving design in papers read within the past two years before the city planning division of the American Society of Civil Engineers. At last month's meeting before the same division a paper on street lighting was read that, among other things, emphasized the aid given to the street lighting engineers by the adoption of zoning and street system plans. Just as the water engineer, for instance, needs to know what portions of the city are to be used for residences, office buildings and manufacturing, so does the lighting engineer—for general as well as street lighting; and the street lighting engineer, like the paving engineer, wants to know the future uses of various streets as regards the classes of traffic they are to carry. The lighting engineer is governed in his planning not only by street traffic and widths but also by the character of the paving surface in relation to reflection or absorption of light. It will tal e a long time to bring these many values of city planning and zoning home to the public and their popularly chosen representatives on city councils and in mayoralty chairs. Not all the municipal engineering specialists fully recognize the value of city planning and zoning in their respective fields and the same is still true of many city engineering heads and staff members. It is from and through all these that the value of city planning must reach the voting public, the mayors and city councils.

Licensing Law Thrown Out

ONE of the first legal setbacks that licensing of engineers has received is the decision of the Pennsylvania Supreme Court that the licensing act of that state is unconstitutional. Reading of the decision, however, shows that it is the detail of the law and not its intent that is disapproved and that it should be a simple matter to write a law that the courts would approve. The Pennsylvania law has been administered with more care and intelligence than in most of the states, but nevertheless it has been bitterly opposed by a numerous body of engineers who do not believe in the general principle of licensing. The decision is in their favor but it does not settle the still disputed question of whether the status of engineering is or is not improved by licensing.

Control of Holding Companies

THE Public Service Commission of New York has recommended to the legislature that it be given control over holding companies to the extent that it can require them to make public record of their activities and to report all revenues and expenses in relation to their public utilities operations. Such legislation is desirable if the holding company is to be kept from falling into such disrepute that it will be legislated out of existence. The rapid spread of holding companies in the public utility field in recent years has caused many to wonder whether financiers are not diverting the holding company from its legitimate uses in order to concentrate part of the profits from controlled utilities in the hands of a few men. The New York commission has taken this fact into consideration as well as the fact that the holding company performs a very useful service in many cases. What it asks for is not the extreme power to control the operations of these companies but rather power to turn the spotlight of publicity upon them, trusting that once these operations are matters of public record the temptation to speculation through the organization of holding companies will be removed for the financiers. Under this limited control the holding companies will still have that freedom of action in financing and rehabilitating small public utilities which is so desirable in such operations, but the public will have a measure of protection against the excesses of promoters.

Doctrine Against Progress

CALIFORNIA'S highest court has decided that the floods of streams must be perpetuated. In passing on the Herminghaus case, it decreed that a particular riverbank proprietor acquired vested rights to the floods of the stream—not to the flood waters as such but to the flood heights—no matter how much waste of precious water and how great destruction these might imply. The decision carries the doctrine of riparian rights to an utter extreme, indeed to the extreme of absurdity. It sets up the doctrine as a bar to progress, and does so, moreover, not on the authority of enacted law but on the strength of court-made law, that body of law which is supposed to base on recognition of the highest equity.

The importance of the case is ample warrant for the space taken to summarize it, on another page. A lawyer of note prepared the summary, which assures its accuracy. Citizen as well as engineer has an interest in it, for every one is affected in some way by the far-reaching influence of water use and stream control.

What the decision says, in brief, is that streams may not be made uniform in flow. Two things follow from this finding, both of them of remarkable importance.

First, the storage of water for use is prohibited. So long as one single riverbank proprietor can claim that some advantage accrues to him from flooding, the flooding must continue and must not be prevented by upstream storage. Naturally it is the lowest lands in the course of a stream which are the flat lands irrigable by submergence. Below them impounding is usually not possible; above them it is now prohibited, under the Herminghaus decision. Thus, the decision attempts to make permanent the waste of water which results from the natural, unregulated flow of streams, and thus it deprives the body politic of a resource without which—at least in the West—it cannot live.

Second, the regulation of streams to prevent flood damage is rendered impossible. The opinion is unqualified in its terms; the expanded riparian-right doctrine which it sets up must hold even if others are injured by the flood flow. Freshets and torrents may tear their way through stream valleys and wreak their periodic destruction, yet they must not be checked or confined if some marsh or meadow lands below are benefited by the high flood stages, which turn the water upon those lands. The California decision gives special dignity and rights to flood channels, though everywhere else such channels, a necessary evil when stream flow is not regulated, are justly held to be objectionable and harmful.

Throughout the West, California excepted, water rights and obligations are governed by the principle of beneficial use and appropriation, and courts as well as laws recognize the supreme public necessity of conserving water by storage and equalization of streams. A decision such as the present one would have been impossible there. In the East, where the doctrine of riparian rights holds sway, there can be as little doubt of the superior right of stream regulation over any conceivable claim to a vested right in flood. California thus has the doubtful distinction of standing alone in the singular application made by its highest judicial authority of the doctrine of riparian rights.

Fortunately, reactionary court doctrine does not endure, especially where it stands so squarely against progress as the present one. Yet, since it is so firmly asserted by the judges that they are willing to overthrow a wisely framed water-use statute with which their doctrine comes in conflict, it may be expected that the decision will control for a period of time. While it remains in force, the development of California's water resources will be fettered; the solid ground on which water supply, irrigation and power rest their enterprises is taken away. There is questionable comfort in the fact that much engineering work will result from the disputes and confusion that inevitably will arise from the decision. Engineers as well as other citizens will hope that the decision may be overthrown at the earliest possible moment.

Inward Looking Contractors

AN OUTSTANDING impression of the Asheville meeting of the Associated General Contractors was the liveness of interest in the problems of the industry by those in attendance. Most conventions of engineers have their dullest moments in the actual sessions. Engineers seem unable to plan programs that arouse discussion or else they are reluctant to give public expression of differences of opinion they unquestionably hold. Not so the contractors. At Asheville they ran away with the set program and the chairmen had finally at every session to shut off the apparently endless fund of opinion which sought expression. That is a healthy sign, not only for the contractor as an individual but for their organization. So long as there are subjects near enough the heart to demand open expression there is assurance that those subjects need discussion and that there should be a forum where the discussion can be made public.

Underlying all of this discussion at Asheville there was a subtle demand for a changing purpose in the association. We say subtle because nowhere was it voiced in so many words and it is doubtful if the speakers realized that there was a singleness of thought back of each specific comment, whether made on floor or in the lobby. But to an observer, weighing everything, it appears that the members of the association are beginning to believe that the work of the association should be more subjective than objective, in other words that more should be done toward improving contracting from the inside than toward improving the relations of the contractor with the rest of the world.

Thus we find the association appointing a new assistant to promote safety and the quantity survey, both developments which lead to better contracting practice. We find the highway contractors demanding a special representative at headquarters whose main duty should be to encourage sounder estimating and bidding. We find a growing importance of local chapters with energetic and efficient secretaries co-ordinating local activities, with the view first of making contracting practice better, secure in the belief that when that results the business of contracting will automatically be bettered.

This tendency has been noticeable for some years but it has had to make its way at times through the theory that there are a number of evils that are imposed on the contractor which must be removed and that his own practices, while important, could be allowed to improve by natural development. If the members of the association are beginning to look within rather than without for their future salvation, the future of the group, and of its parts, is brighter than ever before.

Hotel Demolition Reveals Cast and Wrought-Iron Details

Park Avenue Hotel, New York, Built in '70's, a Type of Now Obsolete Construction with Cast-Iron Exterior Walls and Wrought Beams—Heavy Girder of Odd Cross-Section

WITH THE demolition of the old Park Avenue Hotel in New York City, there has disappeared not only a well-known landmark, but also a fine example of one of the types of large buildings common in New York before the coming of the present steel frame structures. These buildings are of bearing-wall construction other than the exterior walls which are made up of iron castings with ornamental iron facing and are brick filled; they carry practically no load other than their own weight. Wrought-iron beams of an I-cross-section span between the interior bearing walls and support brick arches forming the ceilings and floors. From Fig. 1 an idea may be gained of the architectural detail obtained by the use of the cast-iron exterior walls.

History—Work was started on the Park Avenue Hotel in June, 1869, and the building was completed in August, 1875, at a cost of about $3,000,000, according to the records now available. It was built as a hotel for his women employees by Alex T. Stewart, a pioneer merchant of New York City, who later sold his business to John Wanamaker, by whom the store is now operated. The hotel under the original plan did not prove successful and it was later opened to the general public. It soon became very popular and its inner court, used as a garden dining room, was famous for many years. The architect was John Kellum and the contractor was the firm of Stewart & Smith.

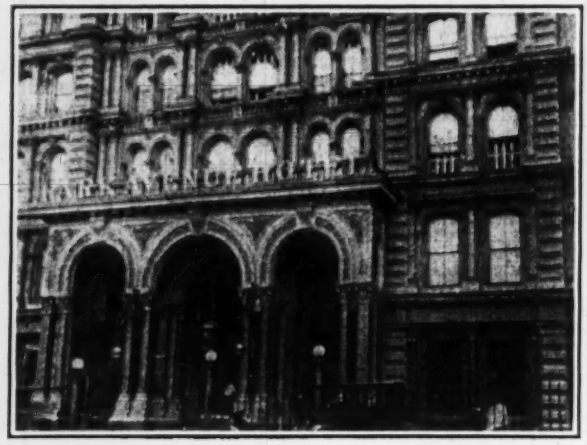


FIG. 1—PARK AVENUE HOTEL SHOWING ARCHITECTURAL EFFECT PRODUCED BY CAST-IRON FRONT

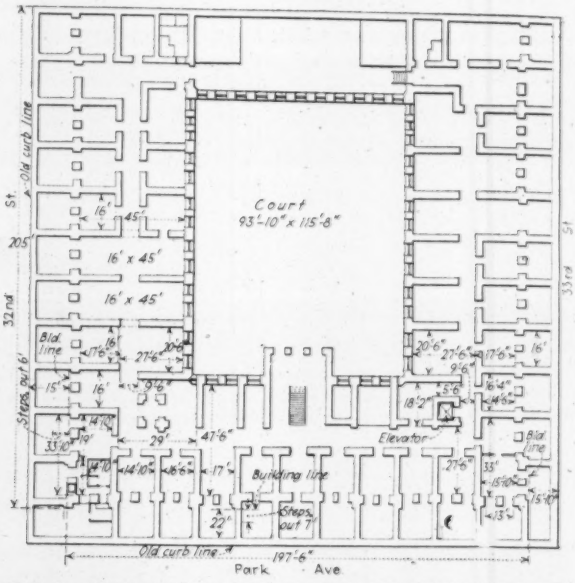


FIG. 2—GENERAL PLAN OF THE PARK AVENUE HOTEL
Exterior walls are non-bearing, with cast-iron front and brick fill, while the interior walls are bearing walls carrying all floor and ceiling loads.

General Structural Plan—The structure was built in the form of a hollow square with a court in the center as shown in Fig. 2. The following data are based upon an examination of the building made while it was being demolished, upon a few original papers still on file in the building department, Borough of Manhattan, and from information supplied by Lyman A. Ford, of Ford, Butler & Oliver, architects, New York City, who have made a number of additions and repairs to the hotel in the past.

The building had a 196½-ft. front on Park Avenue and was 205 ft. deep between 32nd and 33rd Streets. Six stories and a mansard type roof gave the building a total height of 102 ft. The foundation penetrated 18 ft. below the curb, and rested on base stones 6 to 8 ft. wide laid in cement mortar. Rosendale natural cement was used throughout in the building.

Above the base stone the bearing walls varied in thick-

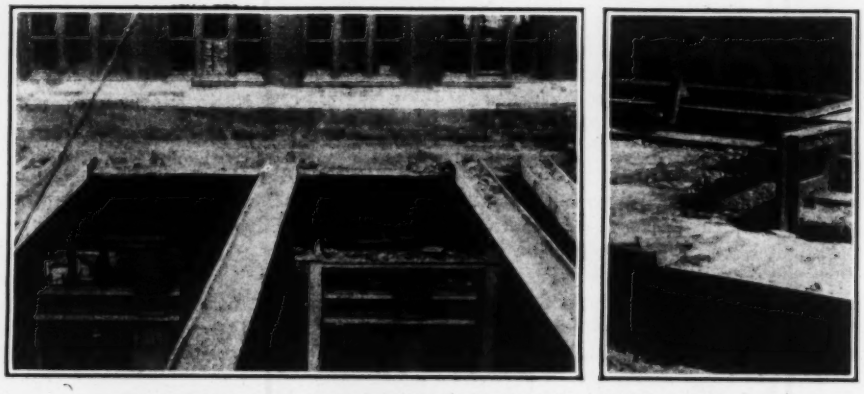
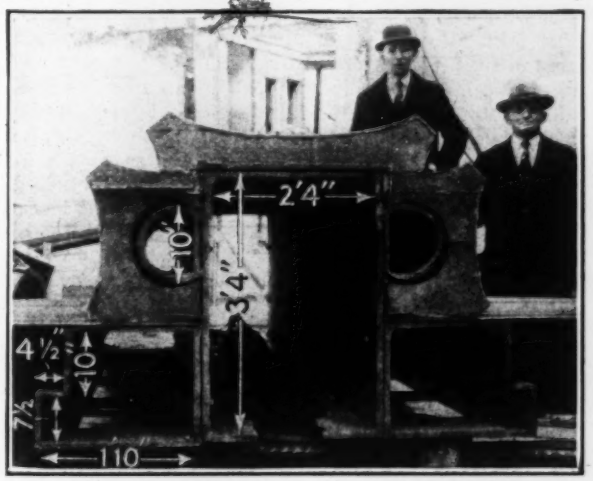


FIG. 3—DETAILS AT JUNCTION OF EXTERIOR WALL SECTIONS
Left: Capping placed between the wall castings at each story; next story wall casting rests on base plate. Wrought ceiling beams in foreground, run parallel to outside wall instead of perpendicular as shown. Right: Cast-iron member supporting cornice.

FIG. 4—TYPICAL ELEVATION AND CROSS-SECTION OF EXTERIOR WALL CASTINGS

ness from 3 to 6 ft. up to the first floor and above this were 2 ft. 4 in. wide up to the top of the building. These walls contained countless 8x8-in. flues, whose original function is not plain from records now available. Ford, Butler & Oliver placed soil pipes in them when bathrooms were installed a number of years ago.

Although the interior bearing walls were continuous from the basement to the roof, the castings on the exterior walls extended only from story to story. On top of each wall section was placed a trough-shaped casting, brick filled, which supported the wall castings of the story directly above. The arrangement of these wall section caps is indicated in Fig. 3. No connections were made between the exterior wall sections of the various stories, each resting in turn on the bearing plates shown in Fig. 3. The ceiling heights of the different stories which were much higher than is now common were: First, 19½ ft.; second, 14 ft. 2 in.; third, 13 ft. 7½ in.; fourth, 12 ft. 6½ in.; fifth, 12 ft.; sixth, 11 ft. 5 in. All floors were 18 in. thick from the bottom of the ceiling beams to the crown of the brick arches. These ceiling beams were spaced on 3-ft. centers parallel to the exterior walls. The cast iron bench angle shown in Fig. 3 supports one side of the first 3-ft. brick arch, the other side being supported by a ceiling beam. Interior bearing walls were spaced approximately on



16-ft. centers although the exact dimensions varied somewhat as shown by the dimensions which are given in Fig. 2.

Vaults beneath the sidewalks on all three street sides of the structure were among the largest in the city at the time the building was built. They extended to the curb line. On the old building, steps encroached on the sidewalk to a distance of 7 ft. on the Park Avenue side, and 6 ft. on the 32nd and 33rd Street sides, but were

removed some years ago and the reinforced concrete shown in Fig. 7 substituted.

Some Structural Details—The exterior wall castings, illustrations of which are shown in Fig. 4, are the most

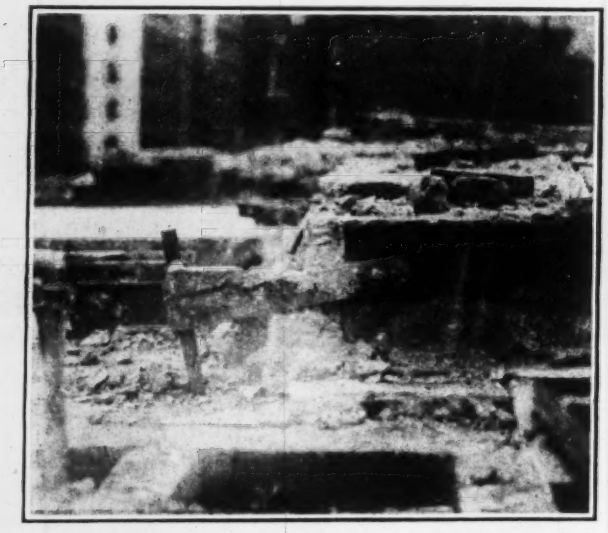


FIG. 5—CEILING BEAMS ANCHORED TO BEARING WALLS

novel of the several details. All connections made to them are by means of bolts; these included coping on the outside and bench angles on the inside, in addition to the assembling of the component parts of the castings themselves. The section of the wall castings is about 1 in. thick.

Where it was necessary to span openings with beams running normal to the regular ceiling beams, as for instance across hallways, necessary ceiling-beam connections were made by means of 5x5 in. cast-iron angles, using $\frac{3}{4}$-in. bolts. These connections are the only ones found in the building since the other ceiling beams resting on the bearing walls are held in place by the surrounding brick masonry and sometimes by an anchor such as is shown in Fig. 5. In Fig. 6 are shown details of the framing plan where a header beam spans a hallway. The header beam consists of two I-beams bolted

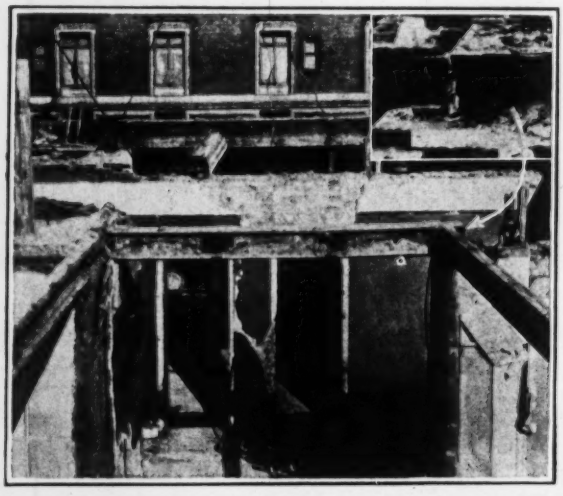


FIG. 6—DETAIL OF HEADER BEAM SPANNING HALLWAY
Insert view shows cross-section of header beam with 5x5-in. cast-iron connection angles.

together as shown in the insert detail; the cast-iron angles and their method of connection are shown. All of these beams are 9 in. deep and, aside from being of wrought iron, do not differ appreciably from present 9-in. steel beams. Some 15-in. wrought beams were used but for the most part 9-in. beams were standard.

Supporting the sidewalks over the vaults on the three street sides of the building was a cast-iron girder of an odd cross-section. This girder, shown in Fig. 7, was

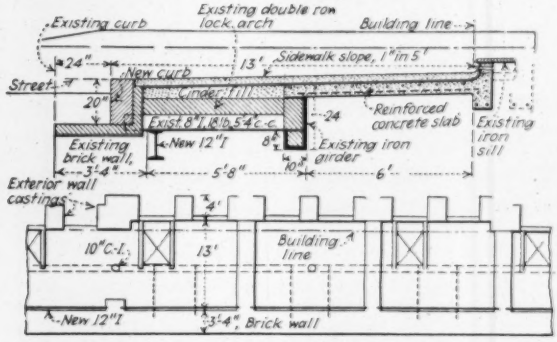


FIG. 7—CROSS-SECTION AT SIDEWALK SHOWING OLD CAST-IRON GIRDERS
Reinforced-concrete sidewalk is new construction replacing old vault lights in a cast-iron grillage. Street has also been widened in recent years as shown.

supported on 10-in. cast-iron columns, spaced 18 ft. on centers. The outside vault wall was of brick masonry 3 ft. 4 in. thick, and spanning between this and the girder were 8-in. I-beams spaced 5 ft. 4 in. on centers. These I-beams supported double rowlock brick arches, on top of which the sidewalk rested. The details shown in Fig. 7 show the construction as it appeared after a 2-ft. widening of the street had been completed and a reinforced-concrete slab placed between the iron girder and the building line. This latter part of the vault had originally been spanned by vault lights set in a heavy cast-iron frame and by stoops at the various building entrances.

The building was wrecked by the Clompoos House Wrecking Co., New York City, and was characterized by them as one of the easiest jobs they had attempted largely because the mortar, in which the building walls were laid up, had crumbled very badly. Two steel derricks were erected at the front corners over the court and were lowered from floor to floor as the iron and brick were torn down and dropped to trucks in the street. A practice out of the ordinary was used in tearing down a large cast-iron stairway. The supports of the top section were removed and it was allowed to drop, crashing the whole stairway into the basement from which the debris was removed.

Soil Surveys Total 24,219 Sq. Miles During 1926

During the past year 75 soil surveys have been begun or completed in 29 states by the United States Department of Agriculture. The total area surveyed in these projects is 24,219 sq.mi., or 15,500,160 acres. This brings the total area surveyed and mapped in detail, since the beginning of the work, up to 708,670 sq.mi., or 453,548,680 acres. Reconnaissance surveys amounting to 574,262 sq.mi. have also been made. Alabama, with a total of 51,133 sq.mi. has received the most attention in this respect; 46,551 sq.mi. in Texas, and 44,238 sq.mi. in Nebraska have been surveyed.

British Tunneling Practice for Rapid-Transit Lines

Shields for Iron-Lined Twin Tubes—Pneumatic System and Power Excavators in Soft Ground—Survey Methods

TYPICAL English practice in the driving of single-track tube tunnels for the London underground railways has been employed in the new 5-mile extension of the City & South London Ry., but with certain modifications to meet new conditions. Particulars of the line and its construction, as given below, are condensed from articles in *The Engineer* (London) and the *Electric Railway Journal*. This new line extends from Clapham to Morden, in the southern outskirts of

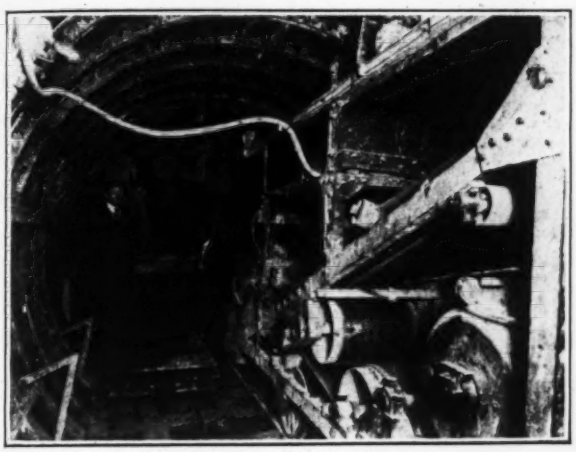


FIG. 1—CONVEYOR HANDLING MUCK FROM SHIELD

the city, and in the last half-mile it comes to the surface in open country.

The two tubes are 11 ft. 8¼ in. in diameter, about 40 ft. below the surface and mainly 5 ft. apart, connected at intervals by passages 7½x3½ ft. for the use of workmen. At stations, however, the diameter is 21 ft. 2½ in. and the spacing is increased to accommodate escalator shafts between the tubes. At one sharp curve it was necessary to increase the diameter to 12 ft. In the stations, the center of each smaller tube is about 9 in. below and 5 ft. 1½ in. distant from that of the larger tube. For economy in current consumption, trains are checked by a rising grade of 1.5 per cent, 600 ft. long, in approaching each station, and their departure is facilitated by a descending grade of 3.3 per cent for about 300 ft. The line is mainly under public streets, but at certain points it was necessary to pass under private property. Careful surveys were made to determine the tunnel, street and property lines and to locate the various public utility services in the streets.

Construction Methods—Construction was divided into ten sections, averaging 3,000 ft. in length, most of these representing the distance between stations. The tenth section included 1,650 ft. of concrete cut-and-cover tunnel coming to the surface and followed by a stretch of open line to the car sheds. This concrete tunnel consists of two rectangular passages 11 ft. 4 in. wide and 11 ft. 3½ in. high, separated by a 12-in. wall. Two of the tube sections were subdivided, where compressed air had to be used in driving through wet ground. For the eighteen service shafts a diameter of 10½ ft. was adopted. On earlier lines the shafts at stations were 16 to 30 ft. in diameter, in order to accommodate elevators and stairways, but on this new line each station has two escalators in 17-ft. shafts inclined 30 deg. from the horizontal. There are seven stations, with platforms 350 ft. long.

Most of the tunneling was done by means of hydraulic shields, erected in chambers on the tunnel lines. For each section; one tube was started in advance, so that the two shields were never side by side. Line and grade were varied as desired by regulating the force exerted by the several rams, but with uniform pressure there was a tendency to nose downward owing to the weight of the shield.

The cast-iron lining rings were handled by hydraulic erecting cranes. For the ordinary tunnel, each ring was 20 in. long and composed of six segments and a key; at the stations the rings were 18 in. long and composed of twelve segments and a key. Each ring was grouted by means of holes in the segments. In the inclined escalator shafts, the segments are of such shape that the upright joints are vertical and the longitudinal joints parallel with center line of shaft.

Materials encountered included stiff clay, shale and

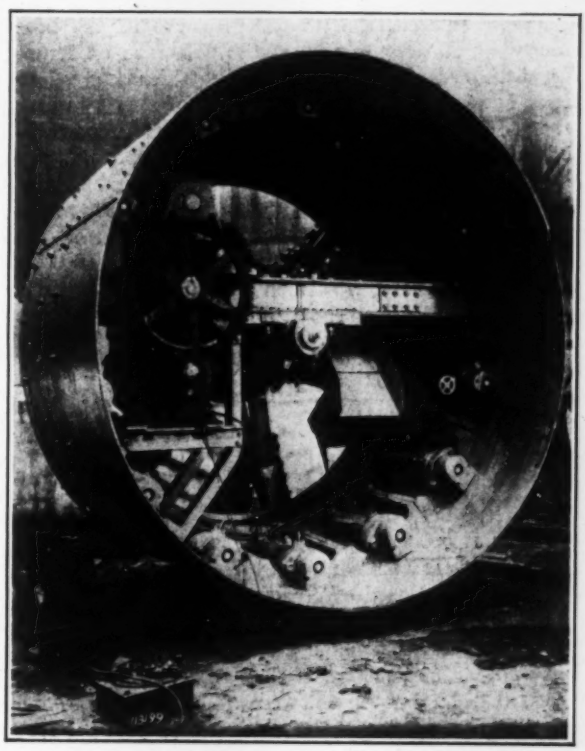


FIG. 2—ROTARY EXCAVATOR FOR SOFT GROUND
Rear view showing muck chute and jacks. Two of the revolving radial arms shown at forward end of shield.

gravel, with some soft ground and wet sand. Test borings were made from the surface and also horizontally at the faces of the headings. The latter borings, made by augers, were used to detect water-bearing strata or other bad-ground conditions ahead of the shield. In the compressed-air work, these horizontal borings served also to detect cavities through which the air

might escape. Fig. 1 shows a conveyor for loading muck from the shield into tunnel cars.

For the compressed-air work in soft and wet ground, the excavation was done by a rotary excavator instead of by hand. This machine, designed and built by Markham & Co., Chesterfield, consisted of a steel shield or shell 12 ft. 8 in. in diameter, having twelve hydraulic jacks around the circumference. At the middle was a motor-driven shaft having six arms or spokes, each of which carried a cutter blade and a bucket to receive the material removed by the cutter. From the buckets the spoil or muck fell into a chute feeding a belt conveyor which extended back into the tunnel and had a discharging hopper to deliver the spoil on either side into small cars operated by electric locomotives on a double-track construction line. Fig. 2 is a rear view, showing the muck chute and jacks. Air-locks were either steel cylinders or 10- to 20-ft. lengths of tunnel shut off by brick or concrete bulkheads. With an average pressure of 10 lb. the minimum and maximum pressures were 5 and 25 lb., but 15 to 18 lb. was the usual working pressure. In passing under a river, the pressure had to be varied according to the tide and the corresponding load on the clay.

Track and Equipment—Bull-head 95-lb. rails 42 ft. long are carried in chairs on fourteen ties to the rail length. The ties, on stone ballast, are 6½ ft. long and have their ends beveled to fit the curve of the tube lining. At stations, however, the rails are on longitudinal timbers in a concrete floor which is trough-shaped between the rails as a measure of safety in case persons should fall from the station platforms, which are level with the floors of the cars. An 85-lb. third-rail forms the conductor. The cars are 49 ft. 9 in. long and 8 ft. 6¾ in. wide, with a height of 9 ft. 6 in. above the rail. They weigh 32 tons for the motor cars and 18½ tons for the trail cars.

For the City & South London Ry., the chief engineer was Arthur R. Cooper; the firm of Mott, Hay & Anderson acted as consulting engineers. The contractors were Walter Scott & Middleton and the Foundation Co.

Michigan Highway Water Survey

In continuation of work begun in 1925, the Michigan Department of Health tested samples of water supply from 805 sources on 5,479 miles of state road for 57 days from July 6 to September 13, 1926. The results of these tests were summarized by E. D. Rich, engineer, Michigan State Board of Health, in an address broadcast recently and printed in the December issue of *Public Health*, the official organ of the Michigan Department of Health (Lansing, Mich.), as follows: "Of the sources tested, 76.3 per cent were found to be safe and 23.7 per cent unsafe. Of the tubular wells 79.4 per cent were safe, of the dug wells 21.1 per cent were safe, and springs 52 per cent safe. Whenever a supply was found to be safe, a metal approval sign mentioned at the beginning of my remarks was posted at the well or other supply, informing the public that this supply is regarded by the Michigan Department of Health as safe for drinking purposes. In addition to the supplies tested there were available along the roads traveled 52 municipal supplies known to be safe for drinking by reason of previous investigations. Approval signs were furnished the officials of most of these municipalities so that they could advertise the public water supply.

Cantilever Bridge Replaces Old Wooden Lattice

Chattahoochee River Crossing Connecting Georgia and Alabama Is Made Modern by Steel Bridge with Concrete Floor

By Searcy B. Slack
Bridge Engineer, State Highway Department, East Point, Ga.

RECENTLY the Georgia highway department in cooperation with that of Alabama and the U. S. Bureau of Public Roads constructed and opened to traffic a new bridge over the Chattahoochee River between Georgia and Alabama, near Fort Gaines, Ga. The new bridge replaces a covered wood lattice-truss bridge built more than fifty years ago. Since its original construction the old bridge has been extended, repaired and strengthened numerous times, and its condition has been

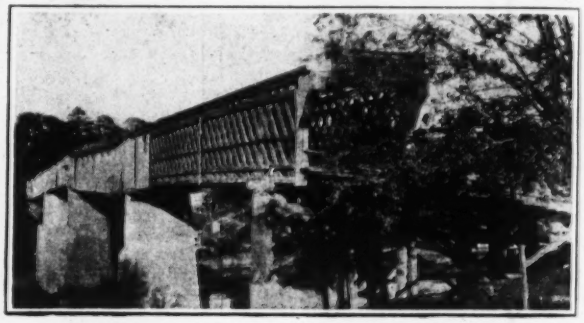


FIG. 1—FIFTY-YEAR-OLD WOODEN BRIDGE
The old structure was long unsafe.

dangerous for several years. The trusses were failing in shear; their sag adjacent to the piers, due to splitting of the web members, is clearly shown in the picture, Fig. 1. The old bridge and large brick piers are now being removed to clear the channel.

Site Conditions—At the site selected for the new bridge there is a bluff on the Georgia side rising about 120 ft. above ordinary water level. On the Alabama side the bank rises about 52 ft. above the water, and the approach to the bridge crosses a wide, practically level, field. The bluff on the Georgia side and the bed of the river are of marl sufficiently hard to give good foundation for piers, but the bank on the Alabama side

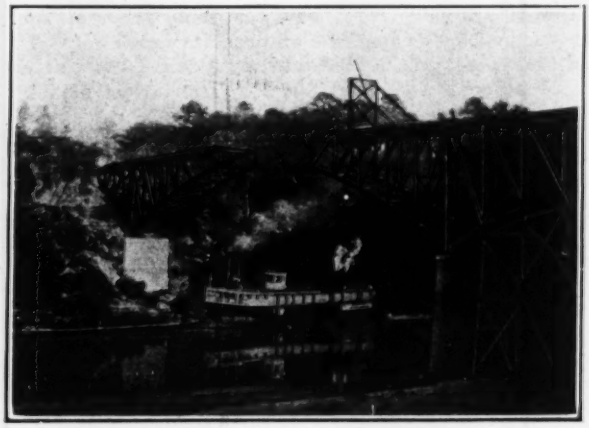


FIG. 2—CANTILEVER ARMS OF NEW BRIDGE
Ready for hoisting suspended span.

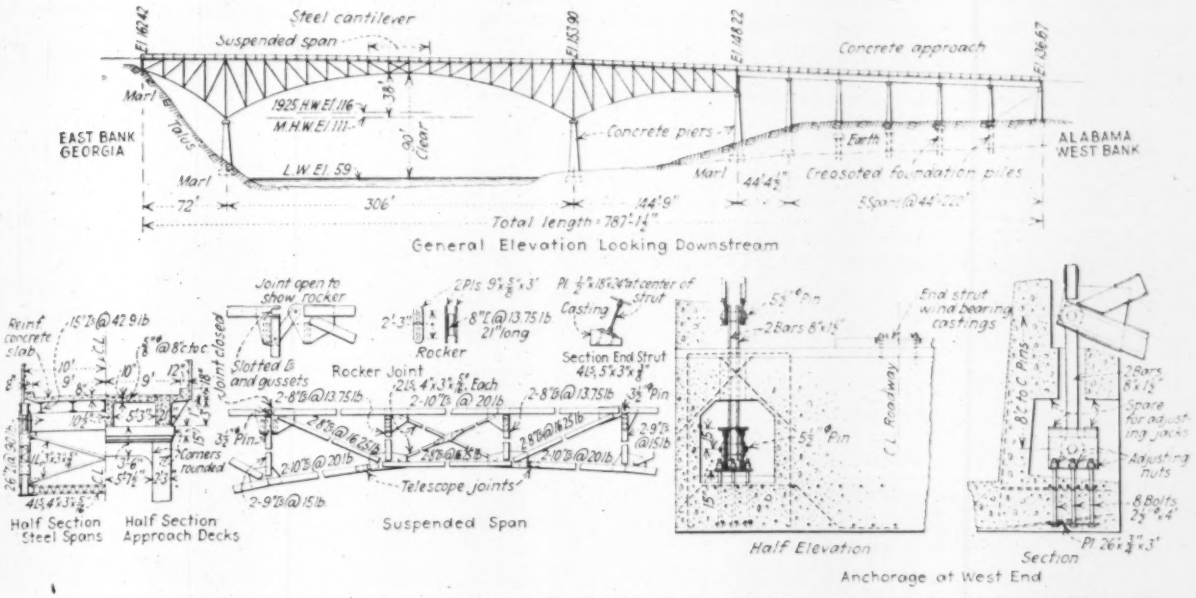


FIG. 3—ARRANGEMENT AND CHARACTERISTIC DETAILS OF CHATTAHOOCHEE RIVER BRIDGE AT FORT GAINES

is of easily eroded silty sand, overlain by marl. The current in the river at the bridge site is rather swift and during times of high water there is a large amount of drift. The difference in level between low water and extreme high water is 58 ft.

The river is navigable and the War Department required either a draw span or a vertical clearance of 85 ft. for a width of 80 ft. above mean low water. The vertical clearance under the old bridge was 78 ft.

Bridge Type—On account of the favorable foundation conditions the first type considered was a spandrel-braced steel arch. But with the wide range between high and low water this design would have necessitated either a high and heavy pier on the Alabama side or an unsymmetrical form of arch, and steelwork extending considerably below high water. For this reason the design was changed to a deck cantilever with the bottom chord of the main span curved to give the appearance of an arch, the approach spans of the cantilever to serve as anchor arms and to be erected on falsework, while neither falsework nor temporary anchorage would be necessary in erection of the main span.

The design adopted, shown in general elevation in Fig. 3, has a central span of 306 ft. with anchor spans of 72 ft. on the Georgia side and 144 ft. on the Alabama side. The central span consists of two cantilever arms of 126 ft. each and a suspended span of 54 ft., fastened to the cantilever arms by pins at one end and by a toggle at the other end to provide for expansion. The suspended span was hoisted into place from a barge.

Adjustable Anchorage—The abutment at the Georgia end is of reinforced concrete and provides anchorage for the steel span. The anchorage (in Fig. 3) is designed to allow for longitudinal expansion, to resist lateral forces and to permit vertical adjustment with jacks. Jacks used in adjusting are placed on top of the pin plates and force is applied between the top of the anchorage pin plates and the bottom of the concrete cover over the anchorage pit. This force relieves the strain on the anchor bolts and adjustment can be made by the double nuts. The anchorage at the Alabama end is provided by toggle shoes and a sliding lateral plate similar to the lateral anchor plate at the Georgia end.

Concrete Approaches—The approach to the steel span at the Alabama end consists of six concrete deck girder spans each 44 ft. in length, supported by concrete bents. The bents are founded on marl or on creosoted timber piles driven to the marl.

The approach fill is 29 ft. high at the end bent. To compact the fill the material was placed in layers beginning at the toe of the slope and working up around the end bent. The only available material for the fill was a sandy loam, and as this material is easily eroded a current break of creosoted timber was built around the toe of the slope and along the upstream side, and all the slopes were planted in Bermuda grass.

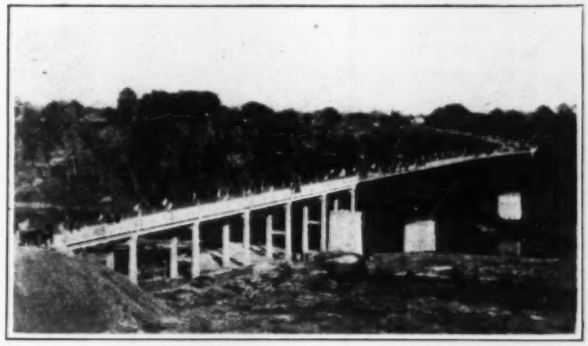


FIG. 4—NEW BRIDGE HAS 306-FT. CANTILEVER SPAN
View on opening day; bridge decorated for the celebration.

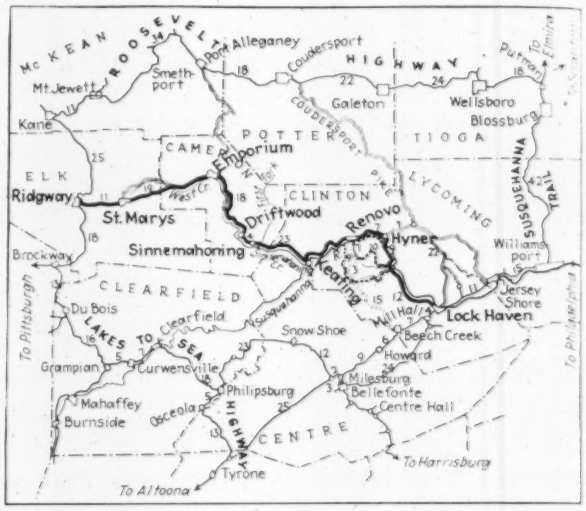
The bridge was designed for live-load H-15 of the specifications of the American Association of State Highway Officials. An allowance of 20 per cent was made for impact on the trusses, and 30 per cent on the floor system.

The total cost of the project including approaches in Georgia and Alabama was $167,795. The cost of the bridge proper was $131,000. The bridge was designed by the writer and was built by Mallory & Nash, contractors for the concrete work, and the Atlantic Bridge Co., contractor for the steelwork.

Second Article of a Series Featuring, State by State, the Highway Developments of 1926 Awarded the Blue Ribbon of Distinction by the State Highway Engineer

The $5,000,000 Ridgway-Lock Haven Highway

By W. H. Connell
Engineering Executive, Pennsylvania Department of Highways, Harrisburgh, Pa.



WHEN the engineers began relocation in 1924, there were 26 railroad grade crossings between Lock Haven and Ridgway. The studies resulted in the elimination of 21 grade crossings and a net saving in traveled distance on the new highway between these points of about 13 miles. The estimated saving to the public, due to the relocation saving of 13 miles in distance, is over $400,500 per year. This is made up of the interest and sinking fund on the capital outlay for 13 miles of construction eliminated, plus the annual maintenance cost and the saving in operating costs for this distance to the users of the highway. The transportation savings are estimated on the basis of about 700 vehicles per day. This annual saving is about equal to the annual carrying charges on the construction cost and the maintenance costs of the entire 103 miles. The cost of the entire 103.37 miles will exceed $5,000,000. The grading involved exceeds 2,000,000 cu.yd.

Location Difficulties — The most difficult problems in location occurred between Lock Haven and Emporium. A reconnaissance in 1924 between Lock Haven and Renovo led the department to believe that it was possible to cross from Hyner to the south side of the Susquehanna River at or near that point and approach Lock Haven on the south side of the river, following the river closely between these points. It was apparent that the grading would be heavy and it appeared likely that there would be a conflict of interests between the department of highways and the New York Central R.R. which had projected a railway on the south side of the Susquehanna River and had purchased the right-of-way but had not undertaken construction. Such a relocation would save many miles to the users of the highway and at the same time there would be no grade crossings difficult to eliminate, such as there would be if further efforts were made to develop the line along the north side of the river where the Pennsylvania R.R. already had its tracks, and where the construction costs appeared to be prohibitive. After extensive location the south side route was adopted.

Two survey corps were put in the field in June, 1925. These men camped in hunting lodges and for a time conducted a large share of their reconnaissance from boats on the river, in this way determining the critical points on the slopes which they later attempted to meet in developing a line on the ground. In November, 1925, the survey parties were increased to ten. The men continued to live in camps, receiving their supplies by boat until extremely cold weather set in, at which time it was necessary to bring the parties into Lock Haven or Renovo for winter quarters. They then went to work daily by train, crossing the river on the ice. Including axemen, about 70 to 80 men were continuously employed on surveys from November, 1925, to February, 1926. Cross-sections were run at 100-ft. intervals from which contour lines were developed from the river's edge well up the mountainsides. Although the line along the river proved feasible, portions of it involved such heavy expense that alternate locations, running up the mountain stream valleys to the south of the river, were tried. These were abandoned due to their increased length without compensating savings in construction costs.

The right-of-way desired by the department of highways overlapped that claimed by the New York Central R.R. in a number of instances. The railroad company, therefore, sent its location and construction engineer to confer with the department of highways for the purpose of working out a solution of the location problems. Surveys of the adjusted alignment were completed on July 1,

PENNSYLVANIA

TYPICAL of the highway work that is being carried on in Pennsylvania, both as to extensive relocation and construction involving great difficulties, is the highway from Lock Haven, in the north central part of the state, through Renovo, Emporium and St. Marys to Ridgway, where a direct connection is formed with Erie, going through Kane, Warren and Corry. For the greater part of the distance, this highway passes through a wilderness, and until it is constructed, Renovo and Emporium, with a combined population of 11,000, are isolated from motor travel for the greater part of the year as winter starts early and spring is late and the earth roads are impassable, except for a few months.—W. H. Connell, *engineering executive, Pennsylvania Department of Highways.*

1926. The cross-section decided upon between Lock Haven and a point opposite Hyner provides, generally speaking, for the New York Central Beach Creek extension to be about 35 ft. above the water, while the highway is from 12 to 50 ft. above the railway, or from 47 to 85 ft. above the river. This provides an unobstructed view of the river from the highway. The highway grade is at an elevation of from 500 to 1,030 ft. above sea level, between Lock Haven and Emporium, and rises to 2,000 ft. elevation between Emporium and St. Marys.

Near Hyner, the highway will cross the line of the proposed Beach Creek extension and then across the Susquehanna River and the present tracks of the Pennsylvania R.R. by means of a concrete arch bridge, eliminating grade crossings at each end. The section between Renovo and Keating presented unusual difficulties because of the large number of grade crossings. This section is a little over 11 miles long, and in this distance ten grade crossings will have been eliminated when the construction on the relocations is completed. Part of this work involves the shifting of several thousand feet of the Pennsylvania R.R. tracks. Extensive relocations have been made between Keating and Sinnamahoning, a distance of 9.6 miles on the new road, involving heavy grading but avoiding some extremely heavy grades and saving 1.21 miles in distance. From Sinnamahoning to Emporium, a distance of 21.82 miles, the saving by relocation was 0.5 mile. One grade crossing was eliminated and two plate girder bridges, each 310 ft. long, were built over Sinnamahoning Creek. Eighteen miles of this work involved heavy grading. From Emporium to St. Marys is now 18.94 miles; this saving of 2.6 miles over the old road was accomplished by relocations which also have eliminated five grade crossings.

LOOKING WEST ALONG ROUTE 105 TOWARD EMPORIUM

The maximum grades are 8 per cent. Generally speaking, however, the grades are light and the 8 per cent grades are very short. The alignment is very good, most of the curves being below 6 deg., with an occasional sharper curve around the sharp points of rock cliff above the railroad, where better alignment is impracticable.

Plant and Methods—In all, about 40 steam shovels have been used in moving 2,000,000 cu.yd. of earthwork. The largest number of men employed on the work at any one time was 400, which is more than 7 per cent of the entire population of Cameron County, the central county of the region through which the highway passes.

The largest project awarded to a single contractor was 18.77 miles of grading and drainage, involving 621,000 cu.yd. of excavation and about 3,000 cu.yd. of borrow. On this project, there are nearly 5,000 cu.yd. of concrete in bridges and headwalls and over 20,000 ft. of tile drainage. It was awarded at a contract price of $647,117, with an allowed working time of 185 days and the requirement that the contractor furnish seven steam shovels of 1¼-cu.yd. capacity, or their equivalent, on this work. The time allowed for grading is 155 working days, or an average of 4,000 cu.yd. to be moved per working day. Another construction company had two heavy grading projects, one of which is completed. This project was 9.74 miles long and involved 158,000 cu.yd. of excavation and 35,000 cu.yd. of borrow. The contract price for grading and drainage was $193,960. The other project awarded to this firm is the 11.24 miles from a point west of Keating to Renovo, on which the excavation is estimated to involve 361,000 cu.yd. of excavation and 8,350 cu.yd. of borrow. On the first contract, the construction company placed seven steam shovels, one of 1¼-cu.yd. capacity and six of ¾-cu.yd. capacity. On the second project, which has recently been awarded, the equipment requirements are five shovels of 1½-cu.yd. capacity, or their equivalent. The allowed time on grading requires an average production of 3,000 cu.yd. per working day. Other heavy grading contracts have been completed. On one project, approximately 190,000 cu.yd. of grading were done with four 1½-cu.yd. shovels; on another, five shovels, one of 1¼-cu.yd. capacity and the remainder ¾-cu.yd. capacity, graded approximately 160,000 cu.yd. On another project, four shovels were used for about 35,000 cu.yd., and on another contract, four shovels were used for grading, involving about 64,000 cu.yd.

Co-operation of Railroads—The construction of this noteworthy project was made possible through the splendid co-operation of the New York Central and the Pennsylvania railroads. G. W. Kittridge, chief engineer, through B. A. Cunningham, location and construction engineer of the New York Central, assisted very materially in co-operating with the department in working up the plans in connection with the section where this railroad was involved, as also did E. B. Temple, assistant chief engineer of the Pennsylvania. The location studies, plans, specifications and work are under the supervision of the engineering executive. Most of the relocation studies were carried out under the direction of Col. W. W. Crosby, the department's location engineer at that time, assisted by the division and district engineers. The survey and construction work is under the supervision of division engineer T. S. Frame and district engineer N. A. Staples. P. M. Tebbs, headquarters field engineer, is the representative of the engineering executive on construction work and on the more recently made location studies and right-of-way determinations.

Concentrated Flow Erodes Rock Below Wilson Dam

Discharging All Flood Water Into North Channel Resulted in Deep Erosion of Rock Beyond End of Apron

By Hugh P. Oram
Captain, Corps of Engineers, U. S. Army

When the north channel of the Tennessee River below Wilson Dam was unwatered in June, 1926, it was found that extensive erosion had occurred at the toe of the 100-ft. and 200-ft. apron extensions, which were built in the summer of 1924, in the north channel of the river after the main dam apron had been completed. From the north shore retaining wall the apron extension is 100 ft. long up and downstream for a distance of 900 ft. out into the river from which point to Jackson Island, which divides the river into two channels, the length is 200 ft. (see Fig. 3). It is constructed of concrete deposited on the stratified limestone of the river bed after removing all loose and disintegrated rock and clearing all seams of their "chert" filling. The supplemental apron has an average thickness of 4 ft. and was secured by 1¼-in. square deformed bars grouted into holes drilled 8 ft. into the underlying rock. Seven dowels, 11 ft. long, were used to each of the 25-ft. square blocks into which the apron

FIG. 1—EROSION BELOW TOE OF APRON

was divided for expansion, each block constituting a separate concrete pour.

While the main dam apron is 12 ft. 6 in. thick at its toe, which was constructed in a foundation trench channeled out of the river bedrock, the supplemental apron has the same average thickness of 4 ft. at its toe as elsewhere, and where the two aprons meet the top of the supplemental apron is at an elevation 6 in. below the apron of the main dam.

FIG. 2—GROUTING REINFORCING RODS INTO ROCK UNDER NEW WALL

The theory of the design was that the velocity of the water would be so materially reduced after leaving the ogee of the dam and passing over 252 ft. of apron, that little if any erosion would occur at the toe and that by first opening the 14 gates on the 200-ft. section the tail water would be built up to a depth of 12 ft. on the apron by the time it would be necessary to open gates on the 100-ft. section.

After the completion of the north channel apron section in December, 1924, the flow of the river was discharged at full gate opening over this apron for a period of 16 months. At low tail water stages it was noticed that a barrier of large rocks was being formed across the channel from 300 to 500 ft. downstream of the apron extension, and in June, 1926, when the flow could be transferred to the south channel, the river bed below the apron extension was unwatered. Large slabs of rock had been torn from the river bed, underneath the toe of the apron extension and from an area extending downstream for a distance of several hundred feet. These had been carried downstream by the force of the water, forming the barrier which had been observed. Many slabs were 200 tons or more in weight. The erosion was greatest at the toe of the apron, which was undermined to a depth of 10 ft. in places where large rocks had been torn loose and the seams had been cleared of their "chert" filling as far back as it was possible to observe (see Fig. 1). The high velocity of water in passing off the apron to the river bed 3 or 4

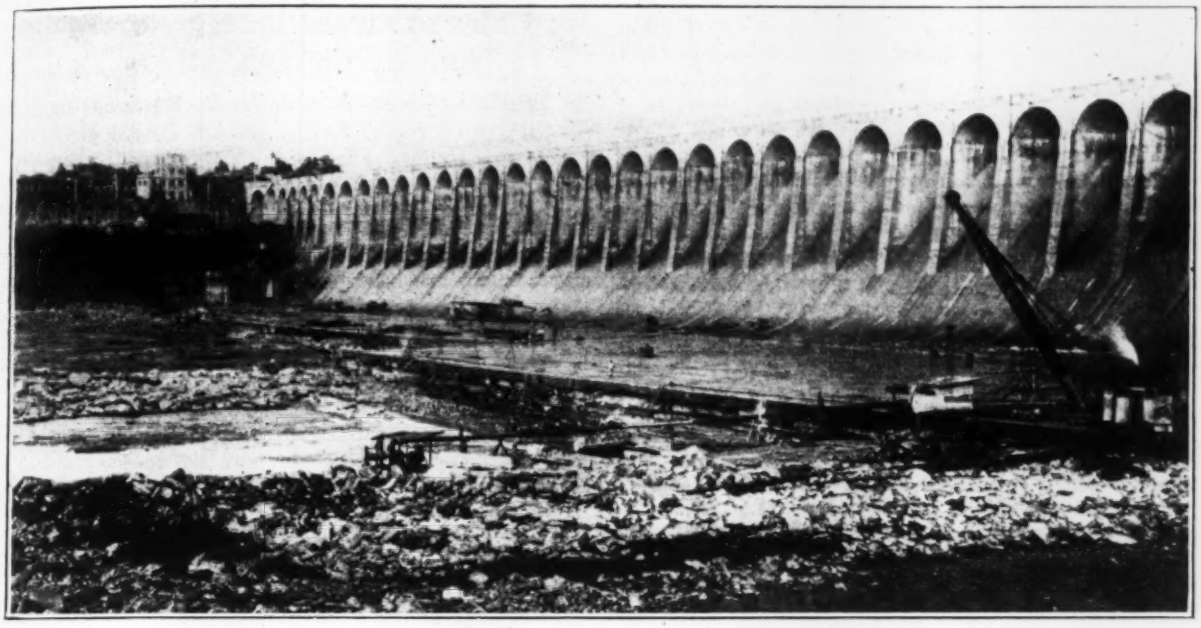


FIG. 3—NORTH END OF WILSON DAM SHOWING EROSION BELOW APRON
The supplementary apron extends 100 ft. beyond the toe of the dam at the north end and for 200 ft. below the nearer portion of the dam.

ft. lower had created a vacuum at the toe, which cleared the filling from the seams in the rock under and immediately below the apron and the water had worked its way between the stratified layers, lifting them and forcing them downstream.

To determine the effect of varying conditions of head and tail water, experiments were made with a small model dam section built to ¼ scale. At full gate opening corresponding to 18 ft. and low water corresponding to normal river stage, it was found that the hydraulic jump occurred downstream of the 200-ft. apron extension and that a vacuum formed at the toe. As the tail water elevation was raised and the gate opening was reduced, the "jump" worked upstream until it occurred on the apron of the main dam section; and until it worked downstream, by increasing the gate opening and raising the elevation of tail water, and passed off the apron extension, no movement of fine material at the toe was noticeable. At full gate opening and tail water elevation corresponding to flood stage, it was found that the jump occurred on the 200-ft. apron extension.

Since these experiments were made the discharge has been spread out over a larger number of gates with partial opening.

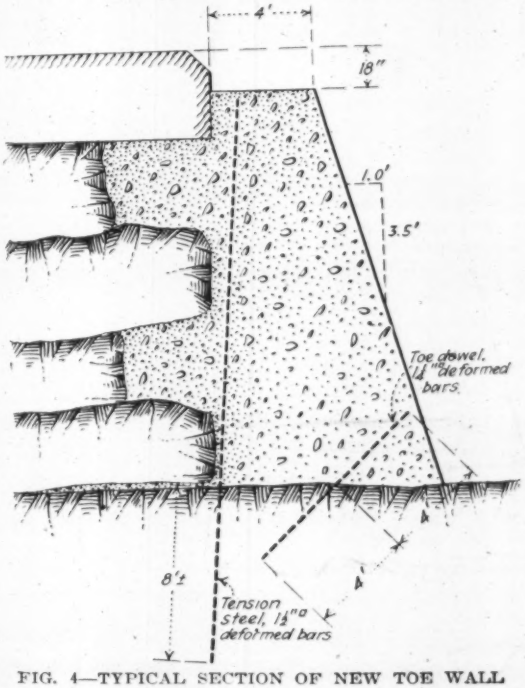


FIG. 4—TYPICAL SECTION OF NEW TOE WALL

New Construction—To prevent further undercutting of the apron a concrete retaining wall was built abutting the toe of the apron and 18 in. below the top of the apron extension. This wall is 4 ft. wide at the top, has a batter on the downstream face of 1 ft. in 3½ ft., and varies in height from 6 ft. to 14 ft. It is reinforced against overturning by 1¼-in. deformed vertical bars grouted into holes drilled 8 ft. deep, and against sliding by toe dowels of the same size, 8 ft. long, set at an angle of 45 deg. and grouted into holes drilled 4 ft. into the foundation rock, which was a hard blue limestone ledge, free from vertical seams. This ledge had been uncovered in places along the toe of the apron and had withstood the action of the water. The wall was built in alternate blocks 25 ft. long, corresponding to the apron blocks and the cavities under the apron were concreted as the wall was poured. A typical section is shown in Fig. 4.

To insure that all rock seams and cavities were completely filled, cement grout was forced through holes drilled in the apron to a depth of 1 ft. below the bottom of the wall. The depth of the seams was ascertained from cross-sections which had been carefully taken at 5-ft. intervals along the toe of the apron and in each drill hole the deepest seams were grouted first by sealing the hole immediately above the seam, thence

working progressively upward. Once grouting was started on a hole it was continued without interruption until all of the seams shown by the cross-section had been filled to refusal. By this method 3,432 sacks of cement were introduced into the seams and cavities.

The damage to the edge of the 200-ft. apron downstream from the junction with the 100-ft. apron was extensive as no provision had been made to protect this flank from the action of the water sweeping along this 100-ft. edge. The downstream corner block was carried away entirely, as well as parts of the adjoining blocks. At this point the retaining wall was carried at an angle of 45 deg., in plan, to join the two sections, and the apron blocks in the triangle behind the wall were restored and securely doweled to the rock as well as to the retaining wall by 1¼-in. steel dowels, which were placed for this purpose when the wall was built.

The concentration of all the flow of the Tennessee River in the north channel was an abnormal operation which probably never will be repeated. Also, as more turbines are added in the power plant and as the upper reaches of the river are regulated by the construction or storage reservoirs and other power plants, there will be less and less water wasted over the spillway at Wilson Dam. Consequently the spillway apron will never again be subjected to such a severe test. Even in times of great floods the attack on the rock below the toe of the apron will be of short duration.

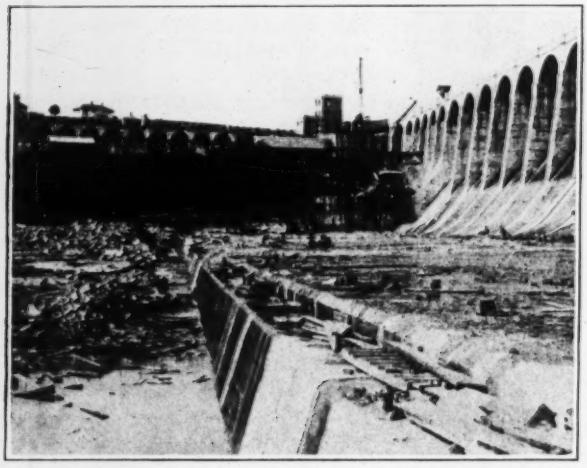


FIG. 5—PART OF THE COMPLETED TOE WALL

The work was carried on in a river bottom without a cofferdam, where a very small rise would have meant the flooding of the excavation and a delay of a week in unwatering again after the water receded. For this reason three 8-hr. shifts were used on the rock excavation and drilling, the formwork and concreting being carried on with either one or two shifts, as the drilling permitted. The qualities involved were 1,175 cu.yd. for rock excavation, 18,240 lin.ft. of 2-in. drill holes, the setting and grouting in place of 62 tons of reinforcing steel and the placing of 3,699 cu.yd. of concrete. Work was started July 19 and was completed Aug. 12, 1926, except for the grouting of the holes through the apron. The total cost was $87,778.

The repairs were carried on under the direction of Lieut.-Col. M. C. Tyler, District Engineer, U. S. Army, Florence, Ala., with the writer in immediate charge of the work.

Chicago Street Traffic Survey and Recommendations

Traffic Commission and Traffic Engineering Bureau Proposed—Congestion Cause and Relief—Parking and Garages

IMPORTANT recommendations for the improvement of street traffic conditions in Chicago, as made by the Chicago Association of Commerce at the request of the city council, are based on conclusions submitted in a report by the association's street traffic committee. Under the direction of this committee an extended traffic survey has been made by Miller McClintock, director of the Erskine Bureau of Street Traffic Research, Harvard University, with Leslie Sorenson, of the Chicago department of public works, as traffic engineer. Five main recommendations may be summarized as follows:

(1) In the first place, an ordinance should be passed creating a Greater Chicago Street Traffic Commission, composed of the mayor and about a dozen officials and representatives of the courts and public boards and commissions, in order to provide for co-ordination of traffic control functions, to develop a system of through streets, to develop standards for safety zones, and to provide for education as to traffic rules and regulations. The need for such co-ordination of authority and responsibility is evident from the fact that traffic planning and control are now exercised by six city departments, eighteen park boards and some special agencies.

(2) A division of traffic engineering as a part of the bureau of streets, in the Department of Public Works, would be created in the same way. This division, headed by a traffic engineer, would study the problems of congestion and accidents, make surveys in connection with traffic regulations, investigate special problems assigned to it by the commission, and supervise the placing, operation and maintenance of traffic signs and signals.

(3) The traffic division of the police department should be reorganized, with a deputy superintendent of police in charge and having a city-wide jurisdiction. This division should organize a school of traffic instruction to improve and unify traffic control. In addition, the division should establish a traffic patrol.

(4) To secure a firmer and more systematic enforcement of traffic law, the central automobile court should be enlarged to handle all but minor traffic cases, and such cases should be removed from the district police courts. There should be a sufficient number of judges to handle cases expeditiously. Minor cases should be dealt with by the traffic fines bureau, as at present, but the bureau should have better support from the automobile court and should take firmer action in dealing with negligent offenders. The handling of traffic cases by the city prosecutor and the state's attorney should be much more firm and systematic.

(5) Steps should be taken for the standardization of traffic signs and signals. The traffic commission should undertake immediately to erect sign standards for the city and the metropolitan area, a survey of the necessary installations being made by the division of traffic engineering as the basis of a program for present and future work.

Present Conditions—The traffic survey covered the

Chicago Metropolitan Area, which is included within a radius of 40 miles from the loop district and had a population of 3,521,843 by the 1920 census, while it is estimated to have 4,512,400 by 1930 and 6,408,000 by 1950. Special attention was given, however, to the points of traffic congestion in the urban district, but it is noted that 125,000 vehicles daily pass the city limits on thirteen paved highways, five of which carry about 66 per cent of this total.

In the central business district, which includes the "loop" district, a count showed that from 7 a.m. to 7 p.m. on a normal day 1,693,500 persons enter or leave the district. Estimating that those who enter also leave the district this indicates that the streets have to accommodate on a normal business day about 846,753 persons, or 25 per cent of the population. Of the total number, 80.8 per cent used street cars, elevated and steam railways and other means of public transport, while only 19.2 per cent used passenger automobiles. On the other hand, automobiles represented 72 per cent of the vehicles in the streets. It is estimated that by 1950 the present ratio of one automobile to 8.9 persons will be one to five.

Traffic Congestion—As to the causes of congestion in the business district, it is pointed out that 105 buildings 12 to 20 stories high have a tenant population of 138,220, exclusive of business visitors and clients, while 24 hotels have a guest capacity of more than 25,000 and 24 theaters have a seating capacity of nearly 29,000. Railway passenger and freight terminals add heavily to the vehicle congestion, as noted in *Engineering News-Record*, Dec. 16, 1926, p. 992. In addition, there are many manufacturing concerns in close proximity to the business district. The uniformity in opening and closing hours for offices and stores adds unnecessarily to the traffic peaks. An example of outlying plants is that of the Western Electric Co., with 38,000 employees, 80 per cent of whom use various transportation facilities.

Lack of street area to care for the increasing traffic is a basic reason for congestion, but the report states that much relief could be obtained by an energetic and comprehensive paving program. Sharp-curve curbs at intersections and elevated-railway columns in the streets interfere with movements, while the total of public and private encroachments (such as news-stands, coal holes, refuse boxes, poles, drinking fountains and building operations) is said to be "astounding." On the other hand, much of the congestion is due to inadequate regulation of traffic movement.

Fast and Slow Vehicles — Since uniformity and smoothness in traffic movement depend largely upon the maintenance of practically uniform speed in a line of vehicles, there should be a segregation of fast and slow vehicles. In Chicago, the rules require the latter to keep close to the curb, but parked vehicles interfere with observance of this rule. Trucking movements cause further trouble, and such vehicles should be excluded from the business district except when they have to pick up or deliver freight within the district. The one-way limit of movement is said to be rarely justifiable for streets, but is very acceptable for alleys; although Chicago has the latter rule it is not strictly enforced.

Pedestrian Control—As to pedestrians, there is general confusion resulting from unregulated movement of pedestrians and vehicles at street intersections. The former are given insufficient protection and the latter are retarded below their normal rate of speed. It is recommended that street crossing by pedestrians within the block be prohibited, except where blocks have definitely marked intermediate cross walks, which should be provided where the blocks are more than 400 ft. long. Such a system, properly and reasonably enforced, would be a general benefit.

Parking and Garages—As to parking, the report says that it must be restricted where it interferes with the primary use of the streets and must be regulated properly in other places, but the present multiplicity of rules leads only to confusion and lack of enforcement. This was noted in *Engineering News-Record* of Nov. 25, 1926, p. 867. Stores in general object to prohibition of parking, on the ground that it will interfere with their business, but a special study indicated that parking patrons represent only 1.57 of the total. It is concluded that greater freedom of movement due to complete prohibition of parking in the central district would affect retail and other trade only to neglibile extent, but would tend to attract automotive patronage which is discouraged by the present congested conditions.

Garages in the business district have a capacity of 8,732 cars, or eight times the curb parking capacity, and 4,200 of these cars are provided for by the parking space in Grant Park (including free space for 1,000 cars). The report recommends greater garage capacity and a development for three times the present accommodation in Grant Park, which is adjacent to the business district.

Study of Timber Resources Is Proposed

A STATEMENT of the economic value of a national program of forest research is made in a report prepared by a special committee of the Washington section of the Society of American Foresters. The forest problem involves: (1) Making full use of 25 per cent of our entire land area for the production of timber, naval stores and forage, and for other purposes; (2) supplying wood and forest products to meet our requirements, which are nearly half of those for the entire world; (3) maintaining the permanence of the forest industries, which rank fourth among American industries, with a capitalization of $3,000,000,000, besides at least $10,000,000,000 for forest land and stumpage. To solve the problem requires: (1) a comprehensive study of forest use and protection; (2) a reduction of waste in the manufacture and use of timber, which is responsible for about 66 per cent of the annual drain on the forests; (3) an economic study of timber supplies and requirements, prices and taxation; (4) development of the forest not only for its products but for its influence on water supply, land erosion, conservation of wild life, and recreation for the people. For forest research the report suggests expenditures of $9,000,000 to $12,000,000 within the next decade, of which 34 per cent might be paid by the federal government and 22 per cent each by industrial agencies, state agencies and endowed institutions. It is noted that as the forest problem is one of land usage, the Department of Agriculture has a large responsibility in such research work. Finally, it is urged that forest research should be developed as a national undertaking on a scale commensurate with the plans for acquisition of public forests, fire protection of the forests, foresty on private lands and agricultural research.

Developing Power on the Gatineau

2 *Heavy Hauling for Dam Building Done by Tractor Trains*

Second of three articles on an initial 400,000 hp. hydro-electric development in Quebec

A REQUISITE for power development on the Gatineau was large water storage to provide regulated flow in a river varying greatly in volume. Studies by the Quebec Streams Commission indicated that the necessary topographical conditions existed in the Lake Baskatong region 120 miles north of Ottawa and 35 miles in from rail head at Maniwaki. Here a natural basin existed which could be closed by a not too expensive group of dams; which would have a catchment area of 6,200 sq.mi. or about two-thirds of the whole river watershed, and which would have a usable capacity of well over eighty billion cubic feet or enough, with the catchment below the dams, to give a regulated flow 8,000 to 10,000 sec.-ft. The storage structures required were a concrete dam with a spillway and control works closing the Gatineau at Bitobee; two bulkhead concrete dams at La Croix Creek and at Castor Lake, and a number of earth dikes and dams at other points and in particlar at Philemon Creek. These dam locations and the reservoir area are indicated by Fig. 1. Their remoteness, 35 miles in the woods, from rail head at Maniwaki, introduced the main construction problems: Camp development, transportation, power supply, local materials production and construction plan.

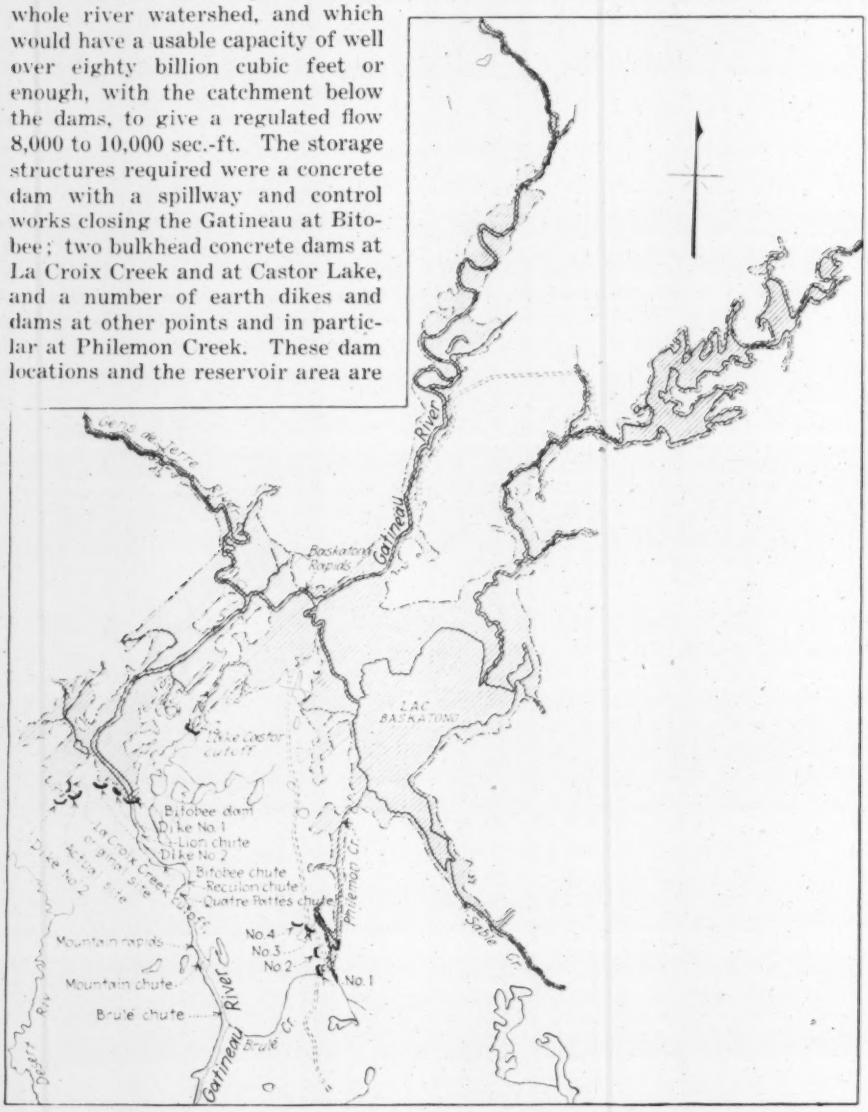


FIG. 1—BASKATONG RESERVOIR AND DAMS FOR REGULATING FLOW OF GATINEAU RIVER

This new lake will have an area of 6,200 sq.mi. and will hold some 86,000,000,000 cu.ft. of usable water. Note the original streams and lakes.

Developing Camp Service—Maniwaki is a little town with no spare living accommodations, only small village stores, no machine shops and no extra supply of labor. Indeed the cities of Hull and Ottawa 83 miles south by rail are the only places which can provide any of these requirements in greater measure. The development for construction operations had then to be complete and pretty well self-contained. The first requirements of a construction plan therefore were: Complete job camps with provision for housing and feeding workmen, sanitation, water supply, hospital service, shops, store houses, commissary stores and all the accessories necessary to comfortable living in winter and summer; and as the four groups of operations—La Croix, Bitobee, Castor Lake and Philemon—were separated there must be three larger camps and at Philemon a smaller camp.

The large effort was toward practical health service—service having a sensible regard for construction costs. Remoteness from doctors and hospitals made essential ample camp provisions for injury and illness. Hospitals were provided with plenty of ward room, with an operating room having essential equipment, including an X-ray machine, with a kitchen and doctor's quarters and with a physician and help. The resident physician had general sanitary direction of the camp and particularly of the camp water supply, which was chlorinated. Close watch was kept of camp and human wastes. The men were made to keep clean and made to have their minor scratches and cuts kept clean and properly dressed. In brief, common and natural means of hygiene and sanitation were enforced and they were effective.

Developing Transportation—The second requirement in developing a construction plan was transportation from Maniwaki to the dam operations. Equipment, supplies and materials had to be brought to the jobs and the equipment of course had to be taken back out. North of Maniwaki was a fringe of farms for perhaps a dozen miles, then a region of woods, slashing, muskeg, small streams and lakes and rugged hills and ravines. Two of the main operations were on the west side of the Gatineau and two on the east side as indicated by Fig. 1. There is no bridge across the Gatineau north of Maniwaki. With these physical conditions there was the time requirement that construction began in November, 1925, and the dams were to be ready in March, 1927, to impound the spring floods. This gave a construction period of less than 18 months.

In planning transportation, thought was first directed to the possibilities of materials production on the job. With a saw-mill and wood working shops provided it was found that all timber and small lumber required could be produced on the river at Bitobee. Also the concrete aggregates and other stone could, it was found, be secured from the excavation and from pits and quarries adjacent to the dams. This cut down the estimate of tonnage to be transported to 35,000 tons after changes, decided on later, in the dam heights had been made. The transportation problem was to haul 35,000 tons of freight upward of 35 miles into the woods.

A railway line was the first thought. About 40 miles of standard-gage line would be required through rough rocky country and across muskeg, and the Gatineau would have to be bridged. The construction cost would be high and the line would have no further purpose after the dams were finished, and its construction, it was estimated, would require perhaps eight months. This long construction period alone put a railway out of consideration if the dams were to be completed at the time designated—March, 1927. The only alternative was transportation by road using trucks or tractors and because of the road conditions—deep snow in winter and mud in fall and spring and in wet weather—tractor haulage promised the best results. Caterpillar tractors had proved their efficiency on snow roads in lumbering operations. They were acknowledgedly efficient on soft ground and in mud. Incidentally road haulage solved the problem of bridging the Gatineau. It was, in particular capable of being put in full operation in a month or so.

The system of roads laid out is indicated by Fig. 2; it aggregates about 70 miles not including specifically job roads. Some of this 70 miles was narrow country dirt road, some was woods trail and 21 miles had to be built new. All the old road had to be widened out and the structures strengthened. The maximum grades were 15 per cent. All this road was dirt with no attempt at surfacing except to build up soft places with corduroy, brush and stable soil. It was dusty in dry and muddy in wet weather.

Selection of hauling equipment had to be largely by guess—there were few data—and operating practice had to be developed by the method of trial and discard. In lumbering in the north the Linn tractor had proved its usefulness; this is a tractor with forward truck wheels and rear caterpillars and a load carrying body. It is designed to carry an 8-ton body load and to haul a trailer. This tractor and a trailer were selected as the hauling unit. For snow road the regular Mussens logging sleigh was selected as a trailer; also the front truck wheels of the tractor were replaced by sled runners. For summer hauling, La Plant-Choate and Athey wide steel-tired wheel trailers were selected. Generally, however, all summer hauling was done with the tractors with body loads only. These hauling units were supplemented by tractors of the more regulation caterpillar type which were used for hauling logs out of the

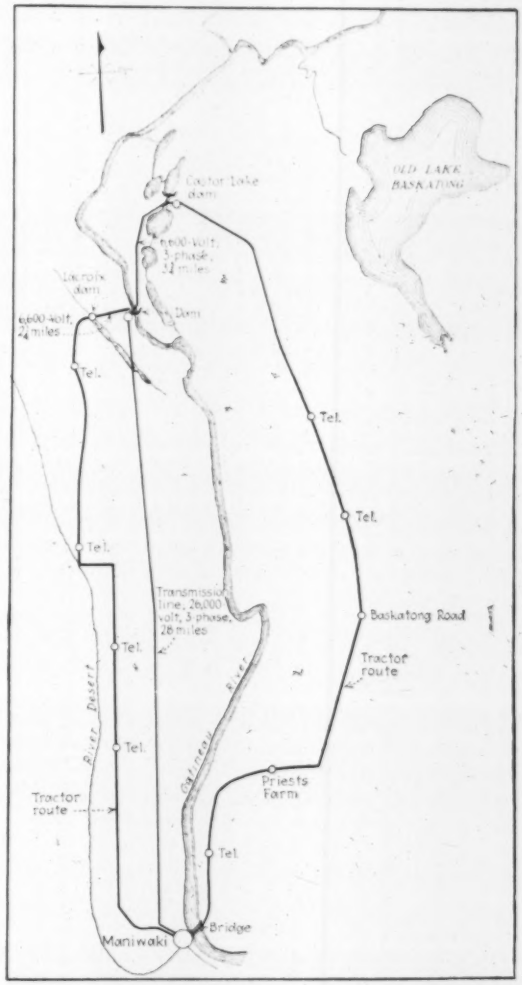


FIG. 2—TRACTOR ROADS AND POWER LINES TO BASKATONG RESERVOIR DAMS

woods and for heavy-draft operations in the railway yard and about the jobs. These were 10-ton Holt machines.

Tractor operation was developed along the lines of railway practice. There were for every motive power unit (tractor) several freight-carrying units (trailers). All "train" (tractor and trailer) movements were scheduled and on the road were reported back to the dispatcher from telephone stations located as shown by Fig. 2. These stations made possible also quick reports of breakdowns or other accidents and the immediate dispatch of a repair gang or other assistance if the train crew itself could not handle the situation. This crew consisted of a driver and a helper whose working shift was a round trip—Maniwaki to job and return, say 60 miles—which took 16 hours. On return to Maniwaki the crew laid off for 16 hours and then

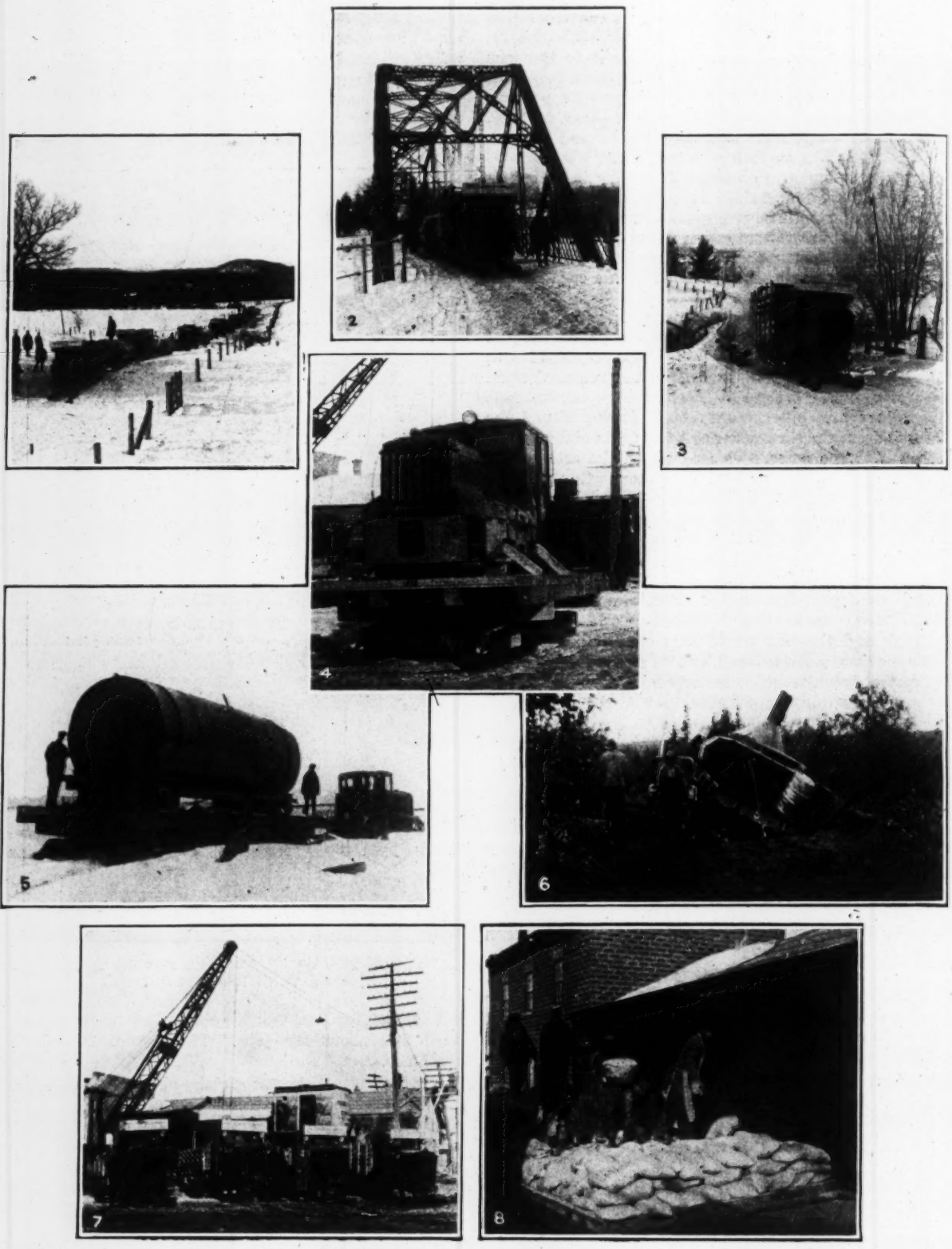


FIG. 3—TRACTOR HAULAGE EQUIPMENT AND OPERATIONS FOR BASKATONG RESERVOIR DAMS

1-3—Three views of tractor trains on snow roads.
4—Logging sled trailer with heavy load.
5—Logging sled trailer carrying steel tank.
6—Wheel trailer mired in woods roads.
7—Lineup of four tractor trains for loading.
8—Loading wheel trailer with cement.

took out another train. The tractor itself was run into the garage and carefully gone over, oiled, given fuel and generally hostled and then given its body load and dispatched with another trailer. Three trailers were provided for each tractor so that one was at the Maniwaki yards being loaded, one was on the road with the tractor and one was at the job being unloaded, so that the tractor never stopped except for hostling and repairs. Generally a tractor made nine trips in seven days. Ten hauling tractors were required.

Naturally the schedule outlined was subject to upsets; breakdowns, bad road conditions and storms interfered at times with smooth operation. The schedule described was the winter schedule when hauling conditions were the best. The ground was hard with frost, the snow packed solid under the caterpillars and the roads improved with travel. The tractors made better speed, suffered fewer breakdowns and required fewer repairs. The logging sleighs worked finely as trailers. Naturally some cold weather precautions had to be taken. Kerosene was used in the radiators, and the tractors when idle for any time were kept in a heated garage; left outdoors the caterpillars and radiators froze. In brief the cold weather precautions were simply those of which every automobile owner knows and practices.

The worst operating conditions were during the spring breakup and again in the fall when the rains came and frost and snow had not set in. At times in these periods hauling was impossible. In dry warm weather the great trouble was dust. All through the warmer seasons the tractor wear was heavy. Dust and mud got into the pinion shaft bearings and crawler parts and ground them out rapidly; warm weather hauling increased tractor wear from 100 to 200 per cent. The wheel trailers did not work out very well on the rough roads and, as stated before, the tractor was most often run with a body load alone.

Virtually all equipment, supplies and materials, except lumber and concrete aggregates, were transported by tractors and trailers. The shipping yards were at Maniwaki where a machine shop and garage, storehouses, switch tracks and offices were constructed. A 20-ton locomotive crane was also installed. The views of Fig. 3 show yard and hauling equipment and operations. Hauling was begun Jan. 1, 1926. The original dam plans gave an estimated total of 20,000 tons to be transported and a haulage schedule of 286 tons a week was laid down as shown by Fig. 4. Then the rock-fill dam planned for La Croix was changed to a concrete dam and the height of all dams was increased 5 ft. This increased the total tonnage by over 10,000 tons and a new schedule of 500 tons a week was laid down. The actual curve of tonnage hauled is shown by Fig. 4. It will be noted how the spring breakup virtually closed transportation. The average load hauled to Sept. 15, 1926, was 18½ tons. The maximum load was 38 tons. In summer the average load was 11 tons. In general tractor haulage worked out well but it required excellent management and care to keep all equipment repaired and in good working condition.

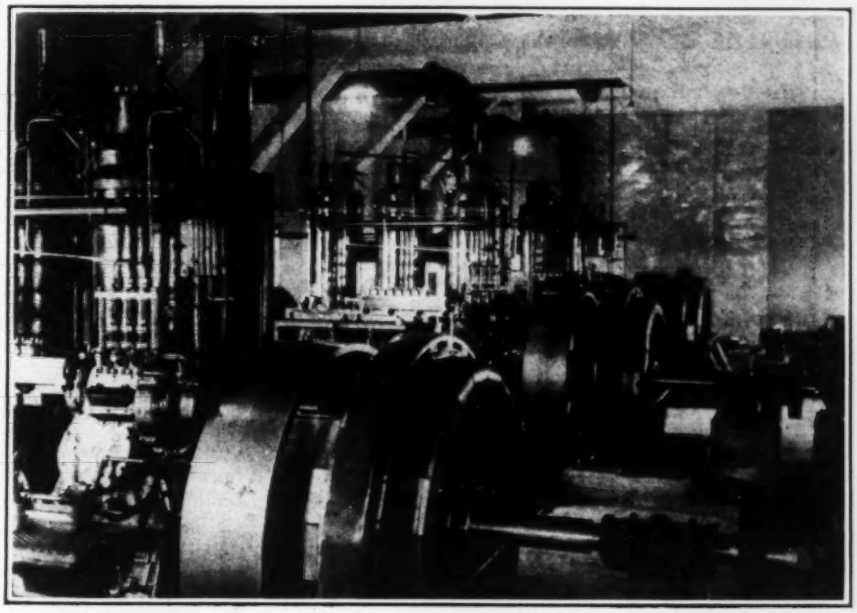


FIG. 5—DIESEL ENGINE ELECTRIC POWER PLANT AT BITOBEE DAM

Three 135-hp. semi-Diesel Anderson engines, direct connected to 160-kva. generators, supplied power until the transmission line from outside plant was completed and then were kept as a standby plant.

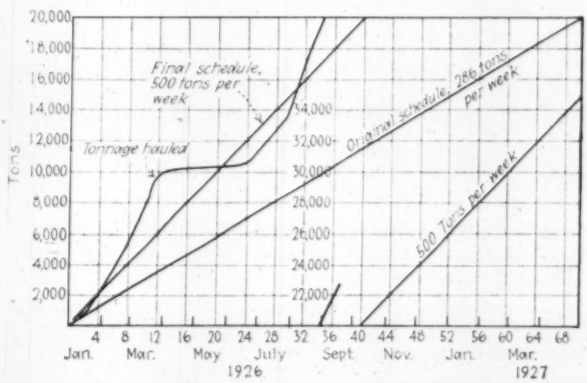


FIG. 4—PLANNED AND ACTUAL TRACTOR HAULAGE SCHEDULE

Developing Power Supply—Power supply for construction was a planning problem second in importance only to transportation. Fuel haulage would be a large factor in the transportation problem; it was wisdom under the conditions to eliminate it. Between 1,500 and 2,000 hp. would be required. Wood from the reservoir site could be used in the sawmill and for other steam generating purposes and for heating. These were but a small part of the fuel requirements, however, if steam or gasoline equipment were to be used. With the transportation burden added to fuel costs and the costs of job distribution there was only one

logical and economic decision which was to bring in electrical power which could be taken from the power plant at Maniwaki. This required some 34 miles of transmission lines. They were laid out as shown by Fig. 2.

Time was required, however. The power plant at Maniwaki was in course of construction, the transmission line had to be constructed in winter and power was wanted at once. This requirement was met by installing a power station at Bitobee to be used while the Maniwaki power plant and transmission line were being completed. The Bitobee power station was then to be kept as a standby source of power. In passing it may be said that it has proved its value as an emergency unit a number of times when the purchased current failed. The Bitobee power plant, altogether, was a rather notable installation for purely temporary construction purposes. Fig. 5 is an interior view.

As indicated by Fig. 2 the 26,000-volt current from Maniwaki was stepped down at Bitobee to 6,600 volts for transmission to La Croix and to Castor Lake and also to 550 volts for local use. At the other dams the 6,600-volt current was stepped down to 550 volts which was the operating current. The motor loads at the three jobs as of Sept. 22, 1926, were: Bitobee 736 hp., La Croix 327 hp., Castor Lake 571 hp., total 1,634 hp.

Direction—The Baskatong storage dams are being built for and under the engineering direction of the Quebec Streams Commission, O. Lefebvre, Montreal, chief engineer. The Foundation Co. of Canada, Ltd., Montreal, is the contractor with R. R. Holland, general superintendent, H. C. Link, assistant superintendent, H. V. Serson, district engineer, and E. V. Gilbert, office engineer, all at Maniwaki, P. Q.

These dams are a part of the power development of the Gatineau River outlined in "Engineering News-Record," January 27, 1926, p. 151. A third and final article will describe the plant planning and working procedure on each of the main dams.

General Contractors Review Construction Practices

Annual Convention Develops Vigorous Attack on Day Labor, Surety Bonding, Lien Laws and the Five-Day Week—Accident Prevention and Quantity Surveys Advanced

PRESSURE for additional service to members called for a review of ways and means at the convention last week in Asheville, N. C., of the Associated General Contractors. About 300 contractors attended the convention. There were ten regular sessions, two sessions of the advisory board and president's council, and two sessions of chapter secretaries. Besides the 14 standing committee reports, there were as many formal papers and addresses. With the routine business the program occupied a full week from Monday to Saturday and then speakers were crowded and discussion was curtailed. Only an epitome of the general proceedings is practicable with a little more complete account of the committee work.

Contracting Business Practices

Opening the convention with a talk on price versus service in construction sales, Col. W. T. Chevalier criticised present practices of selecting contractors primarily on the basis of price, and urged a turn toward selling service first and price second. He challenged contractors to develop better salesmanship. An address on co-operative purchasing by W. J. Matthews gave examples of success in mercantile fields of quantity purchasing and implied that similar advantages might be anticipated from co-operative purchasing by contractors. The report of the committee on equipment and materials, as given later, also commended collective bargaining and there was discussion by several members, some in favor of and some against such an undertaking by the association. The question was not carried through to any decision and no definite action was taken. Gordon C. Ramsey, in a talk on improved relations between government and contractor, called attention to the new standard government contract, bid forms, etc., as summarized in the report further on of the committee on contracts and urged support in the present task of codifying and simplifying the present federal laws relating to contracts.

Surety bonding reform received the usual active discussion following the committee report and an elaborate paper by R. H. Towner. Contending that surety bonding was not insurance but a co-partnership with the contractor and pointing out that always the surety became partner with the lowest bidder, Mr. Towner explained the difficulties of underwriting and asserted that generally it was being done well. "Contract price," he said, "is the controlling factor in successful contract bond underwriting. Where bidding is bad, the underwriting cannot be good. Surety companies cannot estimate contractors' costs better than the contractors do themselves. They can be and they are cautious, and they sometimes reject the lowest bid, even at the cost of sharp official criticism. But they cannot combine to reject it."

Replying to Mr. Towner, Frederick L. Cranford, of Brooklyn, declared that the surety companies, through the expressions of their representatives today, have indicated a lack of willingness to co-operate in the movement to prevent irresponsible bidders from mulcting the building public. H. S. Tullock, of Leavenworth, Kan., declared that the public's interest in the situation imposes a moral obligation upon the bonding companies to share the efforts for reform. He also said that much of the fault of present conditions exists in the system under which field agents of bonding companies operate.

It was pointed out by H. H. Wilson, of Harrisburg, Pa., that the selling of surety bonds and the investigation of those to whom they are issued should be recognized as distinctly different functions and should be divided.

In this connection stress was laid on the assertion that eagerness on the part of agents to sell bonds caused them to neglect proper investigation of the skill, integrity and responsibility of the bidders. The possibility of governmental intervention, if conditions continually grow worse, was hinted by William Ellis, of East Boston, Mass. Mr. Ellis further said that unless surety companies, who hold to present conditions as correct, are faced with competition yet to be produced, no change will ever take place. E. J. Donegan, of the general

council of the Metropolitan Casualty Insurance Co., joined in the argument and a spirited discussion continued for some time.

Other papers on contracting business practices were by Gustave Kahn on the relations of manufacturer and contractor, by W. B. Woods on the responsibilities of architect and contractor, by L. B. Lanfrom on restrictions on freedom in employment, and by W. J. Barney on conditions and practices in contracting which are grievousiy faulty.

Contracting Legislation

The legislation chiefly affecting contracting is the day-labor bill and the proposed uniform lien law. Lien law conditions as they are considered by the association are outlined in the report elsewhere of the committee on legislation. The discussion brought out emphatically the discontent with present lien laws and the hope was expressed that continued effort by the committee would bring about the changes desired in the law being drafted by the Department of Commerce committee. In the matter of day-labor legislation, R. C. Marshall stated that the chance of getting the House bill before the present congress was reasonably good. As reported, amended, from the committee the main provision of this bill is:

> That before expending federal funds on any construction project estimated to cost more than $25,000, and not constituting maintenance or repair, said departments, bureaus, commissions, or other agencies shall publicly advertise, through the usual mediums, for competitive bids to perform such project, and after receiving bids shall conduct said construction project by contract or otherwise: *Provided, however*, That if such bids be reasonable in the opinion of said departments, bureaus, commissions, or other agencies, then said departments, bureaus, commissions, or other agencies shall award the contract to the lowest responsible bidder or bidders, accompanied by such securities as the department, commission, or other agency shall require, conditioned for the faithful prosecution and completion of the work according to such contract.

Highway Section Stresses Service

At the two sessions of the highways division, papers were presented by L. R. Ames on bidding without profit, by T. Warren Allen on increasing road construction output, and by G. F. Schlesinger on maintenance by contract. The main subject of both sessions was practical association service to contractors. The work of the Illinois Association of Highway and Municipal Contractors was taken as an illustration and presented in discussion by A. J. Parrish, A. H. Hunter, and others of that body. Specifically the Illinois association has set out to educate members in methods of estimating and costs of work by developing standard estimate sheets and recording actual costs. At the session, cost records on truck haulage and on earth grading were given in detail and then the estimate sheet was developed in detail by charts and explanation. Concluding this discussion, a resolution was passed urging appointment by the association of a secretary to develop and co-ordinate chapter operations in the highway division.

Committee Reports

Contracts—Progress has been marked in the development and use of standard forms. Sale of the standard building contract developed with the American Institute of Architects is now at the rate of half a million copies a year. The engineering contract has had increased use, but is not yet in wholly satisfactory form. It has not been possible to work out with state road officials a standard contract, but progress has been made in individual states in securing the adoption of major principles. Agreement on a standard municipal contract has been reached with the A.S.M.I., but with a clause providing for a review of decisions by the head of a department in lieu of an arbitration clause. Arbitration generally is accepted by many engineers with extreme reluctance. "Apparently they consider it something which weakens their hand and constitutes a gift of some sort to the contractor." This viewpoint is receding. The new uniform contract for federal works is a great stride. Executive order by the President put this contract in force on Jan. 1, 1927. Work authorized in 1926 amounting to some $165,000,000, will come under the new contract. The Interdepartmental Board of Contracts and Adjustments has also formulated standard invitations for bids, bid bonds, contract bonds, instructions to bidders, and bid forms. It is now digesting laws and court decisions pertaining to public construction, and preparing a single simplified statute which the Bureau of the Budget expects to introduce into the present Congress.—CHAIRMAN JOHN W. COWPER, John W. Cowper Co., Buffalo, N. Y.

Ethics—With the enunciation two years ago of a code of ethics, progress so far seems to have resulted entirely from the moral influence of the majority. Now some consideration of restraining measures seems advisable. Probably in the present state of organization expulsion from membership can be applied only in unusual cases. However, the establishment of a procedure whereby an individual or concern may be called upon to explain some apparent act of unfair dealing seems to offer possibilities as a means of restraint. In a few localities consideration of this plan is under way. In the way of promoting better practices a proposal has been made to the American Institute of Architects to formulate a statement of the respective duties and responsibilities of designer and contractor. A committee of the A.I.A. has this task in hand, but has not reported. To prevent further delay it is requested that the ethics committee of the A.G.C. be authorized to draft a statement or code, publish it for criticism, and thereafter seek approval by other associations. Study of the A.S.C.E. code of professional practices now under consideration is urged, and it is urged that local chapters of the A.G.C. establish contact with local associations of engineers and architects and assist them to strengthen their membership and activities.—CHAIRMAN, ARTHUR S. BENT, Bent Bros., Los Angeles, Calif.

Insurance and Bonds—Rehearsing the complaints of contractors during five years, the activities of 1926 allow the following summary:

> Except for the adoption of joint conference questionnaires by three surety companies, and an occasional gesture toward rational investigation by a few others, no improvement in the bond situation has been noted during the past year. Those few companies progressive enough to attempt adequate investigations, are confronted with a loss of business to reckless competitors who are willing to waive investigation and trust to providence that applicants are responsible. Three hundred thousand independent agents still conduct the investigations of responsibility, as well as run the selling end of the surety business. One company attempted in 1926 to establish a system of merit rating for constructors, which involved rational investigation and a lowering of premium rates, but the effort was of short dur-

ation. It appeared to offer some promise as an entering wedge into a reform of practices, but later showed evidence of being merely a money making scheme, with no visible effort to improve conditions of underwriting. After securing a considerable volume of preferential business from members of the A.G.C., this company abandoned the plan and dropped back into step with its competitors.

At the present time all hope for the voluntary reform of practices seems to have vanished, and the time has come to investigate the advisability of launching a new company.—CHAIRMAN, H. H. WILSON, Winston & Co., Harrisburg, Pa.

Accident Prevention—The effectiveness of local group co-operation in accident prevention, particularly when combined with group liability insurance, is emphasized. With the establishment in Texas of a state-wide group-insurance plan, based on the inauguration of safe practices, a significant step in accident prevention has been made. The plan, like the Detroit plan, combines, with the humanitarian impulse, the prospect of financial saving, and offers the utmost by way of incentive to the adoption of practical prevention measures. The proposed national safety code developed under the direction of the American Engineering Standards Committee contains too many detailed requirements to carry out its intended purpose. It is felt that the enactment of such a minutely detailed code into state law would result in injury to the contracting business without bringing about any appreciable decrease in the number of accidents. In general, it appears that power tending to precipitate adoption of legal codes is centered in industrial commissioners and it seems most important that local A.G.C. chapters establish the proper contact with the commissioners in their states.—CHAIRMAN, W. F. CREIGHTON, Foster & Creighton Co., Nashville, Tenn.

Methods—A great part of the industry has slumped into an apathetic state of mind with respect to estimating and the accounting of construction costs. Contractors have nothing to fear from competition that is based upon actual cost of production and the slicing of anticipated profit. Their real concern is with competition which is based upon ignorance of costs. Methods of educating ignorant bidders have to be borne down on. Primarily they consist of standard estimate analyses and exchanges of information on construction costs. Real cost accounting has to be taught with full consideration of overhead, which is now commonly overlooked. In order to stimulate a practical study of cost accounting and estimating, the committee has presented a complete set of estimate sheets for road work and recommends their study, criticism and use. There is need for careful estimates of longer bidding times and A.G.C. chapters, with their local architects, are working up standard schedules for various types and sizes of construction projects. This procedure should be continued. Opinion on quantity surveying has settled down to the belief that survey bureaus should be a chapter or chapter-group activity. The Texas branch and the Milwaukee, Detroit, St. Louis, Birmingham, Memphis and Denver branches now have such bureaus. Commercial survey bureaus should not be supported. Inquiry among members indicates that cubic contents of the same building as computed by different persons may vary as much as 20 per cent. With this variation existing, it is questionable whether the usual methods of cubing form a sound basis for any sort of comparison. At present a joint A.G.C. and A.I.A. committee are working on a standard method of cubing.—CHAIRMAN, D. B. FEGLES, Fegles Construction Co., Minneapolis, Minn.

Labor—Reviewing the history during the year of the movement toward the five-day week and other labor activities, the conditions are summarized as follows: "The year 1926 has been a fortunate one in being freer of strikes than formerly, wages have been increased in about the same proportion as for several years past, the portent of the new theory of wages advanced by the American Federation of Labor is not yet thoroughly understood, the five-day week introduces a genuine problem, but on the whole the employer and employee are more and more understanding each other's viewpoint and a forecast of the future would seem to indicate that difficulties will be studied and determined to the extent that building operations will not suffer."—CHAIRMAN, NAT MCDOUGALL, A. Guthrie & Co., Portland, Ore.

Construction Development—Outlining progress in promotion of general contracts, promoting responsibility, establishing contacts with other construction agencies, engineering education and waste elimination, particular reference is made to the work of the Joint Conference on Construction Practices in developing questionnaires. The purpose of these questionnaires is to promote accounting, prevent over extension and reveal the general experience of a bidder and his qualifications for a particular project.

They have been approved by the American Association of State Highway Officials, the National Association of Credit Men and the Associated General Contractors. Also they have been adopted with slight modifications in several states and by at least three of the surety companies.

A modified form of the questionnaires has been approved by the Clearing House Section of the American Bankers' Association and has been sent to the 2,400 members of the Clearing House Section. The purpose of these questionnaires, which contain a financial statement, and a project questionnaire, is not to restrict credit, but to enable a contractor to obtain credit to which he is entitled. They will enable a banker to gauge the qualifications of those who ask for credit for a contracting business and will tend to place the contract business on a more satisfactory relationship with its bankers. The bankers state that lending money to contractors has always been considered unduly hazardous, because they could not obtain an accurate knowledge of the individual's responsibility. The new forms are so arranged as to give a clear picture of the contractors' true qualifications and will act as a check on the lending of money only to individuals who are over extended or unfit to undertake a specific project.

In the matter of winter construction, which the association has promoted consistently, it is noted that seasonal fluctuations in certain lines of construction are beginning to decline. It is believed important, however, to call attention to the fact that while winter operations have greatly increased, there has not been any extensive exchange of ideas on methods of winter construction. The pouring of concrete in extremely cold weather presents numerous dangers to those who are unfamiliar with proper methods. Failures are likely to occur, or the methods used if safe, may be inefficient and costly. It is therefore suggested that the association give thought to methods of winter construction

and that it establish proper contact with the engineering societies to develop the subject.—CHAIRMAN, CHARLES WILSON.

Equipment and Materials—Organized contractors have succeeded in developing successful co-operative effort. So far, that effort has barely begun to register in tangible results, but now organization has developed to a stage where direct and tangible returns can be derived.

In the field of equipment, materials and supplies, these tangible returns are plainly visible and can undoubtedly be broadly secured if contractors throughout the country utilize the machine which they have patiently built. If, as individuals, they are willing to exercise the buying and bargaining power of the Associated General Contractors, membership in the national association can, without sacrifice of principle or public welfare, be turned into a sound financial investment.

How far collective purchasing can be applied in contracting at the present time is uncertain, but it can unquestionably be applied to those products not generally considered as direct materials of construction. These include truck and auto tires, gasoline, lubricants, rope, shovels, various sorts of equipment and numerous other products, which reach contractors through jobbing and retail channels. More than a hundred different articles of this sort, including even typewriters, calculators and stationery, are handled by the association mentioned, under discounts varying from ten to thirty-five per cent. These discounts aggregate several million dollars a year to the fourteen hundred members of that association.

As a suggestion for discussion, the committee proposes that the Contractors' Service Corporation, the stock of which is owned by the Associated General Contractors and which has purposely been allowed to become dormant, be revived to engage in collective bargaining and buying.

With these suggestions, the committee on materials and equipment proposes for careful study by the membership, the subject of collective bargaining and buying. It has not yet gone deeply enough into the matter to offer recommendations, but it earnestly urges that contractors keep more abreast with the trend of industry in collective buying than they have with respect to development of an association.—CHAIRMAN, T. J. PARDY, Bridgeport, Conn.

Resolutions Passed

A number of resolutions were adopted by the association, including one on accident prevention; one on adoption of the standard form of construction contract of the government; one that the publication of estimated cost of prospective construction work before bids are received is not of public interest and should be discontinued and asking that a law be passed to this end. The resolutions in connection with the five-day week, as practically unanimously adopted by the association, were in full as follows:

Whereas: Concerted efforts are being made to establish the five-day week in construction, which is already handicapped by excessive lost time from weather and climatic conditions; and

Whereas: The construction industry is still confronted with a shortage of skilled workmen to such an extent that wages have increased far above the scale in other industries and above the trend of the cost of living; and

Whereas: The public may be misled into unsound conclusions by drawing an analogy between the highly seasonal industry of construction and year-round, continuous industries of manufacturing; and

Whereas: The increased cost of construction inevitably resulting from the five-day week and its restriction of output can be paid only by the public:

Therefore, be it resolved by the Associated General Contractors of America, that the five-day, or 40-hour week, in the construction industry is economically unsound, particularly from the fact that restriction of output and ensuing losses cannot be offset by improvement in mechanical means; and

Be it further resolved, that the National Association, its branches and chapters, should strenuously resist establishment of the five-day week; should expose the propaganda directed thereat; and should inform the public of the effect of further curtailing the working period in construction.

The next most important resolution passed was the lien-law expression. This was, in full, as follows:

Be it resolved that any lien law mutually fair to all of the business groups of construction and to the building public and workman should incorporate the following principles:

1. Liens of workmen for unpaid wages should take priority over all other kinds of liens.
2. Those parties having direct contract with an owner are entitled to full right of lien for their material or service.
3. An owner may properly be required to withhold and assist in disbursing funds which remain under his control when he has actually received bona fide notice of lien, but when acting in good faith and meeting obligations according to his contract he should not under any circumstance, be subject to dual payment.
4. Lien laws should not become effective until the owner has received notice of lien and the lien has been publicly recorded.
5. The entire procedure of filing, perfecting and adjusting liens should be shortened and simplified.
6. The priority of liens and the date of their effectiveness should not be such as to make construction unsafe as an investment or curtail the volume of funds flowing into construction.
7. The cost of doing business according to recognized and proper commercial practices should not be increased through complicated procedure established by law.

The problem of day labor and contract procedure was disposed of as follows:

Be it resolved by the Associated General Contractors of America, that the federal bill limiting day labor operations of government bureaus should be enacted into a law, and that similar bills should be passed by the legislatures of the various states.

Change Made in By-Laws

New by-laws concerning dues were adopted as follows: There shall be three classes of dues: (a) Branch and Chapter Members who shall pay $55 per year. (b) Individual Members whose gross business in the preceding year was less than $5,000,000, who shall pay $250 for the year, except as provided in (d). (c) Individual Members whose gross business in the preceding year was more than $5,000,000, who shall pay $500 for the year, except as provided in (d). (d) Provided, however, if an individual member (class b and c) has his principal place of business outside the jurisdiction of any branch or chapter, his dues shall be $55 per year.

A budget of $150,000 was adopted for 1927. Sumner Sollitt, of Chicago, was elected president and L. C. Wason, of Boston, was elected vice-president-at-large.

Notes on the Rôle of Iron in the Activated-Sludge Process

German, American and Canadian Studies Indicate Possible Increased Air Efficiency by Use of Iron

By Abel Wolman
Chief Engineer, Maryland Department of Health, Baltimore, Md.

IN BOTH the experimental and practical uses of oxygen for the oxidation of unstable organic material, through the medium of the activated-sludge process, it has been apparent that the maximum theoretical efficiency of oxygen consumption has never been attained in even a minor degree in practical performance. Efforts to increase the practical efficiency of the consumption of oxygen, so as to approach more completely the theoretical oxygen requirements of the organic matter, have taken various forms. A great deal remains to be accomplished, however, both in identification of mechanism of reaction and in increasing efficiency of process with reduced quantities of air, before we may be sanguine as to the economy of oxygen use. For this reason there is excuse for reviewing certain aspects of oxidation reaction which seem to the writer to offer some possibility of advantage, after considerably more work has been accomplished. Within recent years additional light has been shed on these reactions which may have an implication for the activated-sludge process. Even though such an implication may be remote and indistinct, it still seems helpful to call attention to these studies for what they are worth in clarifying existing principles and methods. Whether the hypotheses presented below will survive more adequate tests by investigators remains a matter for the future. Any hypothesis, however, which leads to further investigation of a troublesome phenomenon has its value in that fact. A disproved hypothesis should bring in its wake useful data.

Possible Rôle of Iron in Oxidation—The hypothesis that iron plays or may play an important part in oxidation reactions is not a new one. The literature of the last four or five decades has frequently referred to that possibility. It is only recently, however, that new form has been given to the hypothesis and that additional investigative work in fields other than sanitary science have appeared to give some confirmation to the significance of iron in such reactions.

In 1924, as the result of investigations during several preceding years, Otto Warburg[1] of the Kaiser Wilhelm Institute for Biology in Berlin, presented certain evidence in which iron was at least experimentally suggested as the oxygen carrier of respiration-ferment. His work appears to the writer to be helpful in relation to the activated-sludge process, in that the problem in respiring cells is one of oxidation reaction.

Warburg presents the thesis that oxidation of organic material directly through molecular oxygen rarely takes place. The experience in activated sludge of excessive oxygen consumption per unit of oxidation would seem to lend some confirmation to such a thesis. He further calls attention to "autoxidizable" substances which have the power of reacting with molecular oxygen directly without the interposition of another substance. In general, organic substances seem to be little "autoxidizable." Iron, on the contrary, is known to react with molecular oxygen. Warburg, therefore, suggests that, in the cycle of oxygen reactions (Fig. 1) molecular oxygen reacts with bivalent iron, forming iron in a higher state of oxidation. This oxidized iron in turn reacts with the organic substances and is again reduced to bivalent iron.

By a series of interesting experiments, he establishes the importance of iron as an oxygen carrier, by choosing substances which react with iron as measures of interference of oxygen transfer in the cell. He presents likewise significant data in which the activation of iron is demonstrated. Without repeating in detail his findings, reference is made to a typical series of his observations, summarized graphically by Fig. 2. These experiments were carried out in the presence of charcoal prepared from an aniline dye rich in nitrogen. Reference to the use of animal charcoal is particularly

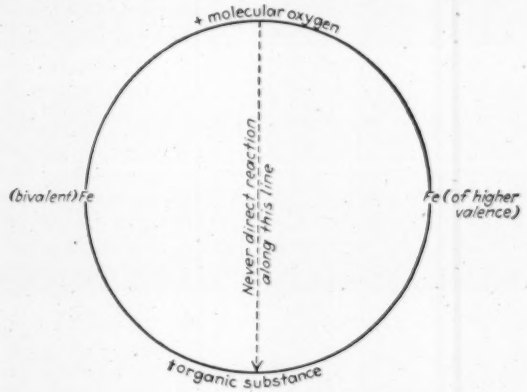


FIG. 1—RÔLE OF IRON IN OXIDATION CYCLE

interesting and important because Warburg emphasizes the advantage, in the transfer of oxygen, of specific chemical forces, in which iron plays a definite rôle, and of the general surface forces provided by the animal charcoal. In other words, the general surface forces provide the physical conditions most satisfactory for the interaction of organic material, oxygen and catalyzer. Ordinary adsorbents, however, which contained no iron were catalytically completely inactive. Reaction took place only when chemical forces were present together with surface forces.

Aside from the possible rôle of iron as an actual oxygen carrier, its additional rôle as a coagulant will be referred to below. This second advantage of iron, or of similar elements, has been accepted by some authors as a contributor to effective activated-sludge process control.

Maryland Laboratory Tests—The work of Warburg in respiration appeared to offer some promise if applied to the problem of activated-sludge treatment of sewage. Laboratory experiments were started in Maryland in the latter part of 1925 and again in February and March of 1926. The results were promising, but conflicting. They were sufficiently attractive, however, to warrant further experimentation on a plant scale which was later carried on at Hagerstown, Md. These experiments were likewise promising but still insufficient. The results will be published later.

In the laboratory tests, efforts were made to deter-

mine the effect of successive additions of small amounts of iron, on the average from 2 to 20 p.p.m., in the form of ferrous sulphate, upon the conversion of organic material to more stable oxidized form. In some of these experiments, oxidation of raw sewage, in the presence of iron, without the addition of any activated sludge whatever, and in the presence of an oxygen supply varying between 0.25 to 1 cu.ft. per gal., was reasonably successful. Changes in organic nitrogen to more stable forms were measurable and significant. So many variables, however, were introduced on small-scale experiments that they were abandoned for more practical large-scale undertakings.

Horowitz-Wlassowa Experiments—During 1917 to 1922, similar experiments, with a different primary hypothesis than that ascribed to Warburg, were carried out in the Hygienic Laboratory of the Institute of Medicine in Petrograd, Russia, by L. Horowitz-Wlassowa[2]. These tests were on the treatment of sewage by means of the activated-sludge process. In this case Horowitz-Wlassowa started out with the assumption that the salts of iron, aluminum, etc., play an important part in the activated-sludge process and that by utilizing this information it would be possible to control the process with a considerable advantage in economy. In his experiments no emphasis, at least as far as the literature is concerned, was placed upon the possible catalytic or oxygen-carrier effect of the iron.

Horowitz-Wlassowa pointed out, in describing his experiments, that the increasing effectiveness of the returned sludge is explained by the fact that sludge passing through the cycle more than once becomes richer in iron, aluminum and other hydroxides, as well as in particular biological forms, so that clarification of sewage and destruction of protein are accelerated. As each new portion of sewage brings in new increments of iron and aluminum, these are oxidized by intensive addition of air and are precipitated as hydroxides, to be used over and over again in the form of returned sludge to the incoming sewage. In this way the amount of coagulation material is always on the increase, until finally its quantitative equilibrium with the concentration of bicarbonates, with the pH of the medium, with the available oxygen supply and with the quantity of reducing materials in the incoming sewage, reaches an optimum. When this point is reached, sedimentation and clarification result.

In other words, according to Horowitz-Wlassowa, the analogy is complete between the clarification and the activated-sludge process in general and the familiar coagulation effects in the treatment of water or the chemical precipitation process of sewage treatment. By the addition of iron or aluminum salts in the activated-sludge process, Horowitz-Wlassowa has found it possible to reduce the percentage of activated sludge which must be returned to the incoming sewage an appreciable amount, indicated by him to approach 2 per cent instead of the usual American practice of maintaining 10 to 25 per cent of sludge by volume in the incoming sewage.

Dallyn and Delaporte—Within the past year (1926) Dallyn and Delaporte[3] have pointed out the possibility of addition of iron in the activated-sludge process. Detailed data on their observations are not available at this writing. Their meager reports, however, indicate that they place considerable emphasis upon the importance of iron and alumina in the activated-sludge process, both as a catalyst and as a coagulant. A more detailed report on their experimental observations should be helpful.

General Significance—The results presented in this paper are fragmentary. They indicate, however, that much is to be gained by further study of the significance of iron, or similar compounds, in the activated-sludge process. There is some theoretical and some practical foundation for assuming that iron may be helpful both as an oxygen carrier and as an adsorbent and coagulant.

In addition, thought should be directed to the function as "catalysts" which the iron compounds most probably perform. If this be true, as seems likely, the catalytic activity results in efficient transfer of molecular oxygen into the oxidation products of the nitrogen, carbon, sulphur compounds, etc.

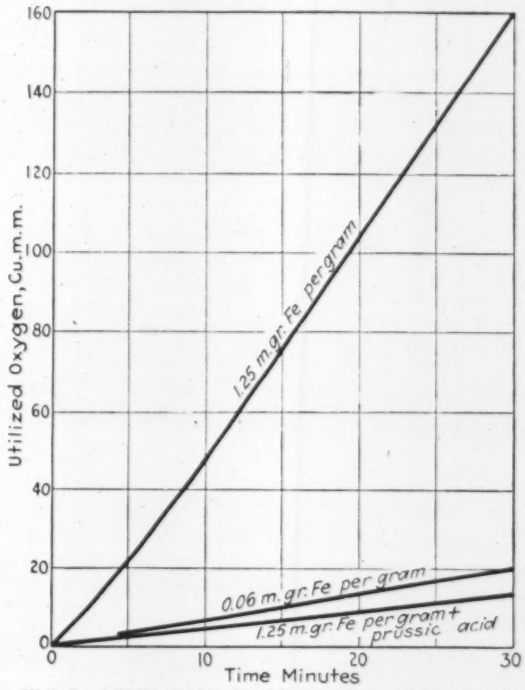


FIG. 2—ACTIVATION OF OXIDATION BY IRON IN PRESENCE OF CHARCOAL

The acceleration with the heavier dose (II) is more than offset by "poisoning" with a slight amount of Prussic acid (III).

In the processes of nature, iron and alumina play such a rôle in the matter of acceleration of fertility of the soil. Production of nitrogen fertility is dependent upon the effective conversion of putrefying organic matter into plant-available nitrates. Soils poor in iron content are generally deficient in nitrate production. Likewise soils containing iron and organic nitrogen are slow to produce available nitrate nitrogen unless the proper hydrogen-ion concentration (pH) of the soil is maintained. Further, in the physiological realm the hemoglobin and in the botanical realm the chlorophyl serve as "catalysts" in the transfer of oxygen to the cell tissues. Both of these highly complex materials contain one activating element in common—iron.

Economy of process control would indicate that these possibilities should be surveyed to the utmost. Further emphasis may be placed upon these preliminary findings on the score that from a superficial survey of the activated-sludge plants in this country and abroad,

those which have given least difficulty in operation dealt with a raw sewage which contained appreciable quantities of iron. When the plants are reviewed with this feature in mind, it is surprising how frequently success or relative failure in the activated-sludge process may be correlated with the existence or absence of relatively large amounts of iron in the raw sewage.

The writer is fully aware of the inadequacy of both hypothetical and experimental data so far available in the final demonstration of the validity of the hypothesis. They are presented largely to call forth more complete investigations. The studies in Maryland have been temporarily suspended because of the discontinuance of the aeration at the Hagerstown plant during the winter. The experiments will be resumed in the spring.

Acknowledgment — The writer takes pleasure in acknowledging the helpfulness of Linn H. Enslow and Frank Hannan in preparing this article.

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[2]On Purification by Activated Sludge. L. Horowitz-Wlassowa. *Zeitschrift für Hygiene und Infektions Krankheit*, 105, 1926, p. 98.
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Court Decision in Herminghaus Water Rights Case

California Supreme Court Denies Power Company Right to Store Waters that Flood Lands of Riparian Owners Below

THE Supreme Court of California has handed down a decision in the now famous case between the Herminghaus Estate, owning lands on the lower San Joaquin River, and the Southern California Edison Co. by whom water is stored on the headwaters of that stream for power development purposes. The decision denies that the power company has the right to impound flood waters of the San Joaquin River.

The decision involves the Florence, Shaver and other reservoir projects of the company's power development in Big Creek and San Joaquin valleys, except Huntington Lake, where the right to store water has long been established. The company has an operating agreement with the lessees of the Herminghaus lands, and construction is proceeding according to schedule.

The power company, finding that the decision does not accept "reasonable" use of water as the basis for interpreting and rating the rights of the parties in controversy, filed a petition for rehearing, contending that the court was in error in holding that the lower riparian owners are entitled to the full flow of the stream as against the rights of upper riparian owners to make reasonable storage of the waters. The United States Attorney-General likewise requested rehearing because of federal interests involved. On behalf of numerous interests, chiefly irrigation districts, other petitions for rehearing were filed, including in a long list of signatures those of three former Justices of the California Supreme Court, and the California Attorney-General. Also represented in these petitions for rehearing were the State Department of Public Works, the Division of Engineering and Irrigation, and the Division of Water Rights, as well as irrigation districts. However, on Jan. 22, the California Supreme Court denied the petition for a rehearing.

A. E. Chandler, a well-known attorney of San Francisco who has specialized in water law, was asked to summarize the case for *Engineering News-Record*. Mr. Chandler was formerly water commissioner of California and is author of "Western Water Law," a subject on which he is recognized as an authority by engineers of the West. Mr. Chandler's review follows:

"Eighteen years ago the Supreme Court of California decided the case of Miller & Lux v. Madera Canal Co. (155 Cal. 59) and therein laid down the doctrine that a lower riparian owner, whose lands are so situated as to be flooded at the high stages of a stream, may restrain an upper appropriator from diverting any of such flood flow. The stream involved was the Fresno River in the San Joaquin Valley, and the court held that the flood water after overtopping the banks flowed on as part of the stream.

"Two years ago the Superior Court of Fresno County decided the case of Herminghaus v. Southern California Edison Co., and restrained said power company from storing any of the water of the San Joaquin River, although the flood often exceeds 20,000 sec.-ft. Herminghaus owns 18,000 acres of pasture land situated on both sides of the San Joaquin River immediately above the confluence of said river with Fresno Slough, which is the northermost branch of Kings River. A number of sloughs traverse the Herminghaus lands between the San Joaquin River and Fresno Slough. The court found that all of said sloughs, regardless of the stage of river flow at which they carry water, were water courses heading in San Joaquin River. It further found that the full flood flow of the river was necessary in order to fill the higher sloughs and thereby inundate and irrigate the higher lands. It also found that 180 sec.-ft. would be sufficient water for the irrigation of all of the land.

"Anticipating that the court would rest upon the earlier case of Miller & Lux v. Madera Canal Co., the power company argued that as an upper riparian owner and as licensee of the federal government, a riparian owner, it was entitled to store waters at the higher stages of the stream as part of its riparian right. The court held that the riparian right did not include the right to store for future use. It further held, however, that the company could operate its forebays for storage for present use.

"The company appealed and was joined by counsel for a number of other power companies as friends of the court. Many irrigation districts, viewing with apprehension the doctrine argued for by the power company, filed briefs as friends of the court opposing the position of each party to the action. They sought the rejection of the theory that the power company could store for future use as within the exercise of its riparian rights, but contended that it should be allowed to store as an appropriator. In support of the latter contention they asked that Herminghaus be restricted to a reasonable use.

"The case was argued before the Supreme Court in January, 1926, and reargued in July, 1926. The opinion was finally filed on Dec. 24, 1926. It was written by Justice Richards and concurred in by four justices. A dissenting opinion was filed by Justice Shenk.

"The opinion affirms the judgment of the lower court.

It 'holds tight' to the doctrine of riparian rights, especially as reflected in the earlier case of Miller & Lux v. Madera Canal Co. It sets forth at length the findings of the lower court regarding the sloughs and the necessity for the high river flows, and finds them fully sustained by the evidence. So far as California case law is concerned, the only thing new in the opinion is the definite rejection of the power company's argument that storage for future use is within the exercise of the riparian right.

"Many of the briefs before the court presented the view that sections 11 and 42 of the California Water Commission Act were valid exercises of the police power Section 11 provides that water in excess of that reasonably needed on riparian lands may be appropriated. Section 42 provides that the term 'useful or beneficial purposes' as used in the Act shall not be construed to mean the use in any one year of more than 2½ acre-ft. of water per acre in the irrigation of uncultivated areas.

"Regarding Section 11, the Supreme Court said:

> In so far as the foregoing portion of said section of said act is concerned it would seem to have no application to the facts of the instant case, since, as we have seen, the trial court has found upon what we deem sufficient evidence that all of the waters flowing in the San Joaquin River down to and upon and over the lands of the plaintiffs herein have been and are being applied to useful and beneficial purposes upon the plaintiffs' said lands riparian thereto and have been so applied by them for more than ten consecutive years last past. . . .

"In considering Section 42 the court examined at length the subject of the proper exercise of the police power of the state and held that so far as riparian owners are concerned Section 42 is invalid. One of its concluding sentences on this subject is the following:

> If the state were here essaying to uphold an effort on its part to work out impartially, unselfishly and in the interests of the whole people some general plan or system for the equitable adjustment of rights and uses in its flowing streams with a view to the conservation, development and distribution of the dynamic forces and generative and fertilizing fructibilities of their waters, it might well be argued that public policy, public interest and a most liberal interpretation of the police powers of the state might rightfully be invoked in support of such an effort. . . .

"As the Water Commission Act is the result of a development covering almost forty years in western water legislation, the above excerpt must be considered a harsh indictment. However, it should be emphasized that the court is referring solely to the provisions of Section 42. No necessary part of the Water Commission Act concerning the appropriation of water or the ascertainment of appropriative rights was before the court for consideration. The usual rumor is abroad that the opinion declares the whole act unconstitutional, but, as shown above, the rumor is groundless; Sections 11 and 42 only are involved. Section 11 is not clearly held to be invalid and Section 42, which is clearly declared invalid, is not an important element.

"Mr. Chief Justice Waste filed a short concurring opinion in which he said in part as follows:

> The prevailing opinion, in my judgment, correctly disposes of the issues and balances the rights of the parties to the present litigation under the doctrine of the use of water, which has been developed by an unbroken line of judicial decisions in this state for seventy-five years. I am in entire accord, however, with the view that this doctrine does not best subserve the ends of present requirements and in its application will be entirely inadequate to provide for the future development of the state. The present and future problems arising in connection with the state's most valuable natural resource can best be met by placing a limitation on its use. A rule that limits the right to the use of water to that which is reasonably necessary for beneficial purposes will best meet these conditions. The state has ample power to enact and enforce such a rule, under the police powers reserved to its inhabitants. . . .

"The dissenting opinion of Justice Shenk is a forceful attack upon the majority opinion. He argues that Sections 11 and 42 of the Water Commission Act are proper exercises of the police power and were in line with the declared policy of the state. He shows that the rule that limits the riparian owner to reasonable use is now general throughout the western states, and insists that California should no longer follow Miller & Lux v. Madera as the Water Commission Act was adopted subsequent to that decision. In referring to the early case of Lux v. Haggin which fastened the riparian doctrine upon California, he says:

> But the conditions prevailing over forty years ago when that case was decided were far different from conditions existing at the present time when the growth and prosperity of the state are so dependent upon the proper conservation of the excess waters of its rivers by storage for irrigation and power uses. That the common law, by its own principle, adapts itself to varying conditions and modifies its rules so as to subserve the ends of present requirements was recognized and decided in 1903 in the case of Katz v. Walkinshaw, supra. Rights to the use of real property, heretofore deemed vested, have been curtailed in the interest of the public welfare. It is axiomatic that all property is owned and possessed subject to reasonable regulations under the police power. There is nothing peculiar to a riparian right, which is part of the parcel of land itself, that should exclude it from proper limitations in the interest of the people of the state. It is difficult to conceive of a question more intimately connected with the present and future industrial and economic development of the state than the conservation of the excess waters of its great rivers. . . .

"The dissenting opinion contains the following on the practice of the plaintiffs:

> The plaintiffs do not pretend to use or to be able to use the great volume of water that flows by their land on to San Francisco bay in the sense that the term "use of water" is ordinarily employed, namely, for the purpose of sinking into or moistening the soil of their lands. The use they demand is to employ this tremendous flow as a booster or a means of conveyance or of transportation to lift the very small percentage of the flow so useful to them to and over their pasture lands. A more extravagant or wasteful use of water could not well be imagined. Two and one-half acre-ft. of water more than annually sinks into their lands. The balance is excess as to them and so far as they are concerned passes on to the sea and is utterly wasted. This waste is not only contrary to the statutory regulation but it works an injustice to the state which is endeavoring to conserve such waters for useful and beneficial uses by appropriators under the laws of the state. . . .

"Justice Shenk concludes that the injunction should be denied and that the cause should be remanded to the lower court for the purpose of ascertaining the expenditure necessary for proper diversion works. He considers that 'the fact that the appellant possesses the power of eminent domain is not a justification for the injunction as ordered'."

Letters to the Editor

A Forum for Discussion of Views of Engineers and Contractors

In Defense of Unionized Engineers

Sir—The editorial in your issue of Jan. 13, 1927, p. 56, under the heading of Professional Progress, criticizing the attempts of underpaid technical workers to find a way toward a solution of their economic problem through organization, has raised a storm of resentment among unorganized engineers, as well as in the ranks of the Union of Technical Men, Local 37, and I feel constrained to say a few words in defense of these technical workers so smugly dubbed radicals.

There are many employers of technical men, technical men themselves, who are favorable toward us. These are not receiving the remuneration due them for the years of education, experience and responsibilities, obviously because the engineering profession has become a cheap profession. This reacts all along the line.

To get back to the editorial in question, the first statement in your editorial which I wish to vigorously controvert is the one in which you say "The problem of the underpaid engineer is complicated and difficult; but neither the New York nor the Chicago move demonstrated that it can be solved by labor union methods."

You make a positive assertion yet you do not submit one word of proof to give it conviction.

The Chicago strike of technical employees on the city payrolls was a hasty and rather poorly organized one, yet I have newspaper clippings before me which seem to prove that these men did wring from the Chicago Board of Aldermen certain increases in pay all along the line.

The New York movement is still very much in the embryo stages. Though the local here has been in existence for six or seven years it has only recently met with any considerable success in the way of bringing large numbers of dissatisfied technical workers within its folds. It was kept alive prior to that time by a small group of earnest and determined men in whom the organization idea had become almost a religion to which they will hold fast as long as breath remains within their bodies.

We have every reason for being hopefully optimistic in regard to what the New York group will accomplish in the near future, but if defeat should momentarily lower our banners, the work will be carried on until such a time as will recognize the engineers' worth, not with a code of ethics whose practical applications are all in terms of profit to the employer, but with a code of economic justice.

Another st ent I take excention to is the one in which you say "Doubtless complete organization, with the force of affiliated labor behind it, will result in momentary alleviation of the salary difficulty for a few men."

Right there your writer appears to contradict himself. If organized labor in the building trades field particularly has been able to hold its gains and advance itself step by step, by the power of organization, (See table on page 79, *Engineering News-Record* of Jan. 13), almost trebling their wages since 1913, why should the alleviation of our salary difficulty be only momentary, assuming that we are organized and have the force of affiliated labor behind us?

Then again if our organization is complete, every technical man from the humble tracer and rodman to the chief draftsman and construction superintendent being in it, why on earth should complete organization merely alleviate the salary difficulty for a few men? Evidently all will be helped.

The third statement of yours with which I disagree most emphatically is the one in which you state the following. "It (the union) has however the balancing detriment of reducing the engineer to the standardization of the hand worker with all the hardships that implies for the individual who would rise. Those engineers who have abandoned hope of elevation and are satisfied to remain journeymen will doubtless be better rewarded as union journeymen, though the many and varied gradations of occupation and reward of the employed engineer lend themselves with difficulty to that essential of unionism, a fixed task and a fixed wage for all."

This might best be answered by pointing out that there is nothing to prevent the carpenter, the electrician, the bricklayer, the plumber and the sheet metal worker from becoming foreman, general foreman, superintendent, general superintendent, contractor and finally a captain of industry. And while they are workers, they receive decent wages and the respect and consideration of their employers.

If we are all united in a powerful organization with the various gradations you allude to, what in Heaven's name could be the mysterious force that could come along all of a sudden and prevent us from rising. There is nothing I know of in the union constitution that will stop a young tracer from changing his grade to designer or squad boss, providing he is able to hold down the job.

We all know only too well that the so-called present grades in an engineering office means nothing at all. Each man is beaten down to the minimum possible regardless of his grade.

The Union of Technical Men proposes to establish minimum rates for each grade, but a man is at liberty to obtain anything above that amount he can from a philanthropic employer.

You next venture this opinion, "Those engineers whose aspirations are above the standardized mean and who suffer from the current depressed reward must continue so far as present prospect goes, to fall back on personal initiative which will lead them into other fields of activity." In other words these men are told to get out of engineering.

The process then becomes as follows:

(a) To spread misinformation through colleges, newspapers, etc. of the marvelous opportunities and remuneration in the technical fields, causing young men to flock to the technical schools.

(b) When the young hopefuls are out of school to wring the best efforts out of them for a mere pittance. This process to continue until they are disillusioned—say—when they are 30 to 35 years old.

(c) To tell these disillusioned ones to go into other fields of activity, meanwhile getting new batches of young hopefuls to work for very little. Very ethical, is it not?

No! We intend to make the engineering profession a livable one to remain in.

Finally you close the subject with this observation. "Meanwhile the organized engineers will have to devote more than their customary time in attention to the problem of forcing upon governing bodies a fair scale of salaries and upon the employing engineer an appreciation of his professional obligation to pay a fair wage for a fair day's work. We must not forget that most engineers are employed."

It is not quite clear to the writer just what you mean when you refer to the organized engineers. Is it the Union of Technical Men, the licensed engineers of New York State, the A.S.C.E., or the A.A.E.?

We have been waiting for ten years for some engineering society to force upon governing bodies a fair scale of salaries but have finally reached the conclusion that we must take off our coats and go to work on the proposition ourselves.

We realize that many of the employing engineers are our friends but at the same time are incapable of paying us a higher wage while they are figuratively cutting each other's throats in the markets of open competition.

The various engineering organizations are composed of fine conservative old leaders of sterling integrity and lofty professional outlook, but who are content to browse along listening to lectures and discussions on weighty problems concerning the welfare of humanity, yet doing absolutely nothing to lighten the burdens of that infinitesimal portion of humanity they come in personal contact with, or have under their charge at their daily tasks.

SIDNEY CONVERSE AMES,
Submitted to and O.K.'D by Technical Union, Local 37.
A. JUDWIN,
Corresponding Secretary.

New York, N. Y.,
Jan. 29, 1927.

News of the Week

Current Events in the Civil Engineering and Contracting Fields

Illinois Engineers' Meeting Covers Wide Range

Rain and Floods—Sewage Treatment—A Ground-Water Supply—Air-Flow Measurement—Paving

Extraordinary rainfall conditions, a gasoline road tax, burning sewage gas, and the development of an unknown ground-water supply were some of the conspicuous features included at the well-attended 42nd annual meeting of the Illinois Society of Engineers, held at Springfield, Ill., Jan. 25 to 27. Good attendance and a close association of visiting and local engineers were aided by joint meetings with the Springfield Engineers' Club and the Illinois section of the American Water Works Association. Officers elected for 1927 include: President, W. D. P. Warren, Decatur, Ill., and vice-president, J. A. Moore, Chicago. The secretary is H. E. Babbitt, of the University of Illinois, Urbana, where the 1928 meeting is to be held.

ILLINOIS RAINFALL OF 1926

The unprecedented rainfall conditions in Illinois last year were dealt with in two papers of special interest. A record presented by C. J. Root, meteorologist, Springfield, showed that September was the rainiest month on record. During the first five days there was 4 to 8 in. precipitation, with several 24-hour falls of 3 to 5 in. On the 8th, 6-in. falls in 13 and 15 hours occurred. At Springfield it was 10.83 in. for Sept. 3 to 8, inclusive. From Sept. 12 to 30 there were eleven rainy days. For central Illinois the average precipitation for September was 12.07 in., or 8.42 in. above normal. The first part of October was also rainy, and during the 35 days Sept. 1 to Oct. 5 the rainfall was 42 per cent of the normal annual rainfall.

In a discussion on land drainage, Professor Shimek, Iowa State University, urged that more attention be given to conservation of wild life and claimed that on some drainage works the ground was not worth reclaiming. On the other hand, Mr. Dappert (Taylorville) referred to cases where swamp lands formerly the homes of wild-fowl are now the sites of thriving cities and of farm lands producing crops worth $100 an acre.

Precision measurement of air-flow by weighing, as presented by Professor Polson, University of Illinois, included description of a weighing device for standardizing secondary air-measuring devices. This work is being studied in connection with warm-air heating. Land and property surveys are always live subjects in this society, and problems with lost or disputed corners as factors were outlined by W. D. Jones and M. L. Greeley, Chicago, while Wm. Krumer discussed cases in which city building restrictions are evaded.

Comprehensive development of secondary roads, construction and maintenance of these roads by the counties under state supervision (instead of by the state), and a 3c. gasoline tax with funds applied largely to the counties in which the tax is paid, were three suggestions in a paper by D. O. Thomas, county highway superintendent at Belleville. The other side of the road situation was presented by Frank T. Sheets, chief state highway engineer. Widening Chicago's 66-ft. streets to 100 ft., with 70-ft. roadway, was described by J. A. Moore, of the Bureau of Local Improvements. The policy has been to widen the outlying sections first. There is increasing demand for wider roadways on business streets having car tracks; 38- and 48-ft. roadways in 66- and 80-ft. streets can be increased to 48 and 60 ft. respectively without inconvenience to pedestrian traffic, provided the stores are required to keep their wares off the sidewalks.

Experience and experiments in the collection and burning of gas from Imhoff tanks at Decatur was an unusual subject presented by W. D. Hatfield. Developments in sewage treatment processes were reviewed by Dr. A. M. Buswell, chief of the Illinois Water Survey, while sewage irrigation at Denver was described by C. B. Burdick, Chicago. Construction methods on the Bloomington and Springfield disposal plants were described by Stanley Pinel & W. B. Walraven, respectively.

The discovery and use of a water supply from a buried river valley at Sullivan, Ill., was an interesting case described by W. D. P. Warren. Two papers were devoted to the design and operation of the Springfield water softening and purification plant. Other subjects on the program were the lime softening methods used at Columbus, Ohio, by Charles P. Hoover, chemist of the filtration plant; the co-ordination of sewage and water treatment, by Paul Hansen, Chicago, and the water supply dam at Streator, Ill., by F. G. Gordon, Chicago.

Engineering Fifty Years Ago

From *Engineering News* Feb. 3, 1877

AT A meeting of the Common Council of New York City, Jan. 25, it was decided, "That the Commissioner of Public Works be requested to report upon the system adopted by the Liverpool Water Board, for the prevention of waste in the use of water and the practicability of applying the same or some similar system to the water pipes in this (N. Y.) city."

Donaghey Out as Wisconsin Highway Engineer

Resignation Asked by Commission But No Explanation Given—Kuelling Is New Appointee

John T. Donaghey, state highway engineer of Wisconsin, on Jan. 25 was removed from office by the state highway commission. He was replaced by H. G. Kuelling, former construction engineer for the commission but more recently in consulting practice in Milwaukee. Following Mr. Donaghey's removal M. W. Torkelson, secretary of the commission, resigned. The removal of Mr. Donaghey has not been explained by the commission, except that it was "for the good of the service," and in a statement of Dean F. E. Turneaure, one of its members, that "there existed a very serious degree of dissatisfaction among the engineers in the highway organization."

The state highway commission consists of two ex-officio members—the state geologist, E. F. Bean, and the dean of the engineering school of the University of Wisconsin, F. E. Turneaure—and three appointed members. Of these the two ex-officio members and two other members voted to remove Mr. Donaghey and one member after voting against removing him, resigned from the commission. Charges are being made that the action was dictated by the recently inaugurated governor Fred R. Zimmerman and that he was influenced by A. R. Hirst, former state highway engineer and candidate for governor, who is now vice-president of the National Vibrolithic Co. Mr. Kuelling, the new state highway engineer, has been consulting engineer of the Wisconsin Vibrolithic Co.

Collapse of Stack at Birmingham Due to Rusted Rivets

(Special Correspondence)

Collapse of the 90-ft. stack on the power house of the Birmingham Electric Co. at Birmingham, Ala., on Jan. 14, which resulted in the death of two men, is believed to have been due to rusting of the heads of rivets concealed between the outside shell of the stack and the lining.

The stack had been in place about 25 years. It was of ¼-in. plate and lined to within 30 ft. of the top. The point of failure was 48 ft. below the top and at the time of the accident the work of relining the stack had been undertaken and the old lining had been removed to a point about 6 ft. below the point of failure.

Examination of the stack showed no rupture of plate but pitting to the depth of half the thickness of the plate on the inside and heads of rivets badly corroded. Failure occurred through shearing of the rivets in the region where the corrosion occurred.

Estimates Made of Lakes-to-Ocean Canal Traffic

Department of Commerce Estimates Traffic Tributary to Proposed Canals

As a part of the economic study for the proposed Great Lakes-St. Lawrence and Lakes-to-Hudson ship canals, the Bureau of Foreign & Domestic Commerce of the Department of Commerce has prepared estimates of the traffic available for movement by the three canal projects proposed for opening the Great Lakes to ocean traffic, the St. Lawrence River route and the Lakes-to-Hudson route. The figures given are those for potential traffic, but no attempt has been made to determine the amount of such traffic which would be diverted from the present traffic routes to the new traffic routes.

The bureau estimates that from 19,000,000 to 24,000,000 long tons of foreign and domestic cargo (12,000,000 to 17,000,000 being imports and exports) are available for movement via a Great Lakes-St. Lawrence ship waterway, and 15,000,000 to 20,000,000 tons of foreign, intercoastal, and coastwise cargo (8,000,000 to 13,000,000 being imports and exports) are available for movement via a Lake Ontario-Hudson ship channel. The bureau estimates that local traffic stimulated by the construction of the latter route may be sufficient to equalize the difference between the two routes.

Wheat was chosen as the commodity for which it was easiest to make a reliable estimate of the cost of handling, also because it would be likely to move in the greatest volume. Careful estimates show that it could be carried from Duluth or Chicago through the proposed St. Lawrence shipway to Liverpool for from 8 to 11.2c. a bushel as compared with the cheapest present combination of rates of 17.6c. and from the same port to the same destination through the proposed Lakes-to-Hudson ship channel for 9 to 12.9c. per bushel.

Cost Per Ton

Taking the figure for the cost of construction and operation prepared by the engineering boards which reported recently and combining them with its own tonnage estimates, the bureau has derived the cost per ton of cargo handled given in the accompanying table. On the St. Lawrence route these figures would be just half, as far as the cost to the people of the United States is concerned, if the cost of construction is divided equally between Canada and the United States. The "All-American" route given in the table is the same as the Lake Ontario-to-Hudson route with the addition of a canal around Niagara Falls in American territory.

On the assumption that the saving in freight rates for wheat is an average, a gross saving of from $3.36 to $2.39 per ton will be obtained through the expenditure of from $0.53 to $0.42 per ton on the St. Lawrence route and a saving of from $3.21 to $1.75 for an expenditure of from $1.90 to $1.44 on the Lake Ontario-to-Hudson route and for an expenditure of from $2.39 to $1.78 for the so-called "All-American Canal." These figures are based on the assumption that *all* the traffic which is available for transportation through the proposed canals will move by that route. On the other hand, the traffic figures are based on figures for the period between 1921 and 1924 and do not take into consideration any possible increase between 1924 and the date of completion of either canal.

Route	Interest, Amortization, Maintenance, and Operation	Estimated Tonnage	Cost per Ton
St. Lawrence	$30,000,000	19,000,000 to 24,000,000	$0.53 to 0.42
Lake Ontario to Hudson	28,770,000	15,000,000 to 20,000,000	1.90 to 1.44
All-American	36,000,000	15,000,000 to 20,000,000	2.39 to 1.78

North Carolina Engineers Hold Annual Convention

(Special Correspondence)

The North Carolina Society of Engineers, the North Carolina Section of the American Society of Civil Engineers, and the Charlotte and Raleigh branches of the American Society of Mechanical Engineers in their convention last week adopted a legislative program to submit to the General Assembly, and authorized a committee on professional practice and a minimum fee scale.

At the closing meeting, Jan. 29, the North Carolina Society of Engineers elected W. Vance Baise of the State Highway Commission, president; Harry Tucker, State College, vice-president; and re-elected A. L. Hooper, of the Bureau of Public Roads, Raleigh, secretary-treasurer.

During the convention the civic clubs of Raleigh observed Engineers' Week by inviting a prominent member of the profession to speak at the meetings of all of the organizations during the week. C. A. Mees, retiring president of the state engineering body; Theodore Johnson, consulting engineer of Raleigh; and Gilbert White, of Durham, were the speakers. The keynote of these addresses was the need for creating a better understanding on the part of the public of the engineer's problems.

The principal discussion of the convention revolved around the question of a minimum fee scale, advocated by C. A. Mees, retiring president of the state organization, and a code of practice. Mr. Mees urged that the minimum fee be adopted for the protection of the young engineer.

This recommendation, together with that for a general code of practice, also recommended by Mr. Mees, was referred to a committee to be named by the new president and which will be instructed to report at the next meeting, which will probably be held in Wilmington this summer.

Among the legislative proposals endorsed by the North Caroline Society of Engineers were recommendations of the North Carolina Section of the American Water Works Association asking an annual appropriation for the biennium of $20,000 from the state for stream gaging; $10,000 for a survey of the underground water sources of eastern North Carolina.

Pennsylvania License Law Unconstitutional

State Supreme Court Finds Exemptions Unfair to Engineers Resident in the State

The Supreme Court of the Commonwealth of Pennsylvania has declared the engineers licensing act of that state, of May 2, 1921, to be unconstitutional. The decision was rendered in a test case brought about through the voluntary arrest of an engineer in Monroe County following the declaration of unconstitutionality of the law in the Court of Common Pleas of Lackawanna County, noted in *Engineering News-Record*, Sept. 10, 1925, p. 444. Subsequently the Court of Quarter Sessions of Monroe County declared the act unconstitutional and the case was carried to the State Supreme Court on a writ of quo warranto.

Basis of Attack on Act

The act was attacked on several grounds. First, it was contended that it legislated upon three different subjects: (1) the profession of engineering, (2) land surveying, and (3) the lawfulness of work and contracts connected with public improvements, and consequently was in violation of the state's constitution, which prohibits the legislating upon more than one subject in any single act. In the second place, it was attacked on the ground that it went beyond the police power of the state. On this subject, the court said: "Of course, under what circumstances the safety and welfare of the community would seem to require the protection afforded by a professional registration act is primarily for the legislature to decide, and when that body concludes that engineers—who have to do with the construction of our great bridges, reservoirs, and buildings, together with other structures which touch the daily life of all the people—must have their qualifications certified by the state, we can hardly say that such an act is, prima facie, an abuse of police power; for a mistake made by an engineer in figuring the strain and stress capacities of the various members that enter into many latter-day constructions might lead to such a loss of life as would amount to a public calamity."

The third ground upon which the act was attacked, and the one upon which the court based its decision of unconstitutionality, was that it interfered with "the equality of opportunity" of engineers in the state in that it made an unreasonable classification in those exempted from licensing under the act. The act exempts non-residents who offer to practice as professional engineers or land surveyors within the state, also non-residents who are licensed to practice in other states who do practice for not over 30 days of any calendar year, employees of licensed engineers, officers and employees of the United States Government and of the Commonwealth of Pennsylvania and officers and employees of corporations engaged in interstate commerce as defined by the Interstate Commerce Act, that is chiefly the engineers of

the larger railroad companies. The court questioned the legality of the first exemption and in the case of government and state employees stated that it also questioned the legality of the law because its language might well be construed as meaning that such employees were exempted from the law even if practising beyond their engagement with the federal or state government. It stated, however, that such a classification might be warrantable on the theory that the legislature might properly assume that the federal government would employ none but qualified engineers.

In regard to the final exemption, that of officers and employees of a corporation engaged in interstate commerce, the court says that it can think of no conceivable justification for this exemption, and it observed that the law does not state that these officers and engineers are exempt merely while engaged in interstate commerce work, but that they are wholly exempt from registration and may freely practice the profession of engineering in Pennsylvania. Also, as the definition of such corporation is that contained in the Interstate Commerce Act, the court finds that it would be necessary to read the Interstate Commerce Act into the Pennsylvania statutes which would make the exemption of doubtful validity.

On the question of whether the unconstitutionality of the above exemption invalidates the whole act or whether it can be cut out of the act and leave the remainder in force, the court says: "We cannot presume that the legislature would have passed the present act without the exemption contained in paragraph (g) of Section 24 (exemption of employees of concerns in interstate commerce) any more than we are warranted in thinking it would have passed the act even though all the numerous exemptions inserted therein had been omitted; hence, we must assume these exemptions to be inseparable expressions of the legislative will, and, as one, at least, of them is unconstitutional, the whole act falls."

Separate Professions

Returning to the matter of whether the act deals with more than one subject and thus becomes unconstitutional on that ground, the court says:

"Both in its title and throughout all its provisions, this statute is written as treating of at least two subjects, first, 'engineering' and, next, 'land surveying.' As the act is drawn, the latter occupation is not treated as a mere subordinate branch of the former. The act constantly refers to 'the profession *of* engineering' and usually adds, immediately thereafter, 'or *of* land surveying'; and, thus, by using the conjunction 'or' and repeating the preposition 'of,' it conveys the idea of two professions. Section (a) defines the term 'professional engineer' in such a way as not to include a land surveyor: then immediately afterwards it defines 'land surveyor.' Had the legislature made the definition of engineer broad enough to include a land surveyor, as engaged in a minor branch of engineering—and this, perhaps, it might have done—there would have been no necessity for subsequently defining a land surveyor; the fact of the presence of the two definitions indicates in itself that the first was not intended to include the second.

Finally, the court in considering whether a third subject is legislated upon in the act through the imposition of certain duties upon the commonwealth and political subdivisions thereof in connection with public works by providing that it shall be unlawful for them to engage in any construction work involving engineering unless the plans have been approved and the construction supervised by a registered professional engineer, states "It is a grave question whether this provision can be held to be merely subordinate to the main thought of regulating the practice of engineering, and whether it does not constitute a third and separate subject of legislation, namely, the regulation of the lawfulness of work, and, incidentally, of contracts, connected with public improvements."

Upon this subject as well as others noted the court does not render a decision. It finds that the granting of exemption to employees of corporations engaged in interstate commerce renders the whole act unconstitutional.

Col. Henry Prout, Engineer, and Editor, Dies

Civil War Veteran, Colonel in the Khedive's Service in Egypt—Editor of Railroad Gazette

Col. Henry G. Prout, distinguished civil engineer, for 16 years editor-in-chief of *Railroad Gazette* (now *Railway Age*), died at his home in Summit, N. J., on Jan. 26, in his 82nd year. Col. Prout had not been actively engaged in business since 1915, but had devoted a large part of his time to the preparation of a biography of George Westinghouse, published four years ago.

Henry Goslee Prout was born at Falls Village, Va., Aug. 10, 1845, and while still an infant moved with his parents first to Greene County, N. Y., and later to Berkshire County, Mass. His early education was obtained in the Stockbridge Academy and by tutoring. In 1863, at the age of 18, he enlisted in the 57th Regiment of Massachusetts Volunteers, and served with the Army of the Potomac in the Wilderness and later campaigns until he was mustered out of service in 1865. Two years later he entered the University of Michigan, where he continued his education by four years of study. During this time, two of his summer vacations were spent on government surveys of the Great Lakes and before the close of his senior year he left college to take up similar work in the Rocky Mountains. During his second year on this work he commanded an expedition of reconaissance with the Military Division of the Missouri of the U. S. Army in southwestern Colorado, which ran an unbroken stadia line of 1,000 miles, crossing the Continental Divide seven times. This service brought him to the notice of General Sherman, then head of the army and former commander of the division, who recommended him as one of six men for the military service of the Khedive of Egypt. Mr. Prout went to Egypt with the rank of major of engineers in 1873 and remained there for 4½ years, rising to the position of Governor of the Equatorial Provinces and retiring with the rank of colonel.

In commenting on this service, *Railway Age* says: "In the service of the Khedive, as major of engineers, Prout's first year was in the Delta and on the Asiatic frontier. It covered geodetic and topographical engineering, studies for a hospital and a military prison, repairs of fortifications, and the administration of the engineer bureau of the War Office (Cairo). In all of this he had an independent command, as was the case with all of his subsequent service. After the first year he went to the Soudan in command of an expedition to Kordofan and Darfour; and thence he was sent to the head of the Nile as governor general of the Provinces of the Equator. This was at the request of Gen. Gordon, whom Col. Prout succeeded in that command when Gordon came down to Khartoum as governor general of the Soudan. . . ."

When Col. Prout returned to America in June, 1878, he entered the service of the Toucey & Buchanan Interlocking Switch Co., of Harrisburg, Pa., a company which later became one of the constituents of the present Union Switch & Signal Co. After a year or so of this work, Col. Prout entered the printing business as a member of the firm of Atkins & Prout, a firm which printed the *Railroad Gazette* for several years, before Col. Prout became editor of that paper in March, 1887.

During the next 16 years, as editor of *Railroad Gazette*, Col. Prout took an active part in railroad matters throughout the entire country. To quote again from *Railway Age*:

"He was without doubt the greatest technical paper editor of his day; and to his leadership may be attributed much of the progress in railroading in America at that time. . . . There are few living now who know that to an editorial written by Col. Prout and read on the floor of the United States Senate was due the selection of Panama instead of Nicaragua as the route of the Isthmian canal."

In 1903, Col. Prout resigned as editor of *Railroad Gazette* and as a member of the board of directors of the corporation to become first vice-president and general manager of the Union Switch & Signal Co., a position which associated him with the Westinghouse interests in an advisory capacity. In July, 1914, Col. Prout, then president of the company, resigned and in November of the same year became president of the Hall Switch & Signal Co., a position which he held until his resignation and retirement from active service.

From 1893 to 1895 Col. Prout served as a director of the American Society of Civil Engineers. The University of Michigan conferred the honorary degree of LL.D. on him in 1911.

Control of Holding Companies Proposed in New York

The Public Service Commission of New York State, in its annual report to the legislature, recommends that the Public Service Commission law be amended so as to permit "inquiry into the cost and profits accruing to non-utilities from that branch of their business having to do with the furnishing of products or service to operating utilities for ultimate distribution to the consuming public." It is also recommended that the statute be amended to define as holding companies those corporations which control operating utilities in the state, not only by ownership of the majority of stock, but also by lease or operating contracts or by control through voting trustees. The commission proposes that holding companies be required to file periodical reports on forms prescribed by the commission and that the commission be given authority to investigate the relationship between the holding companies and operating utilities.

The commission states that there is no criticism of a legitimate holding or investment company occupying its proper place in the utilities field, but that prior to regulation, over-capitalization was one of the causes which brought about a public distrust and hostility toward utilities.

Texas County Begins $7,000,000 Highway Construction

Harris County, Texas, has begun the construction of a concrete road program involving total expenditures of over $7,000,000 and covering the building of twenty roads. The program embraces 135 miles of concrete construction and 100 miles of bituminous surface.

Bids are being asked on the construction of the La Porte Road, about 8,850 ft. long.

Changes Made in Engineers of Pennsylvania R.R.

The board of directors of the Pennsylvania Railroad Co. has approved a number of changes in the engineering department, effective Feb. 1. Alexander C. Shand, chief engineer, has been promoted to be assistant to the vice-president, Elisha Lee, who also is an engineer and under whose direction the new terminal at Philadelphia is to be built. Mr. Shand has been succeeded as chief engineer by T. J. Skillman, the former chief engineer of the Long Island Railroad Co., a subsidiary of the Pennsylvania. E. B. Temple, formerly assistant chief engineer at Philadelphia, has been promoted to be chief engineer of the Eastern Region. I. W. Geer, assistant chief engineer at Chicago, has been promoted to be chief engineer of the Western Region, and W. D. Wiggins, assistant chief engineer at Pittsburgh, has been made chief engineer of the Central Region.

J. T. Wallis, chief of motive power, has been promoted to the position of assistant to the vice-president in charge of operation and F. W. Hankins, general superintendent of motive power, Pittsburgh, succeeds Mr. Wallis.

Navigation Congress Acts Upon Many Subjects

Five Days of Technical Sessions Held in Cairo—Trips to Aswan and Suez

The fourteenth International Navigation Congress which met at Cairo, Egypt, Dec. 6-22, 1926, considered 77 papers on navigation and allied subjects and adopted formal conclusions on a number of subjects brought up for discussion. The papers which were presented had been printed and distributed to the members of the congress some time in advance of the meeting, so that discussion was largely of a formal character, prepared in advance of the meeting.

The congress was held under the patronage of the King of Egypt who opened the formal session and also received the delegates at the Royal Palace. Five days were devoted to technical sessions, the topics under consideration being divided into two sections, those pertaining to inland navigation and those pertaining to ocean navigation.

Before the technical sessions began, two days were devoted to visiting points of interest around Alexandria and a day's trip down the Nile to the Delta dam. After the technical sessions, there was a four-day trip to Aswan dam, 500 miles above Cairo. The congress closed with a trip through the Suez canal to attend the formal opening of Port Fuad, which is opposite Port Said.

Recommendations

Among the conclusions and recommendations of the congress was one recommending the creation of an international commission of high dams, whose function would be to gather and co-ordinate the results of corresponding studies made in various countries. The creation of such an organization was recommended at the World Power Conference held in Basle, Switzerland, in August. The congress also recommends that in the study of hydro-technical questions that the results of tests on small-scale models be compared with results on full sized structures in order to bring out particularly to what degree the law of similarity applies. It also recommends that the permeability of foundations and the extent to which the passage of water takes place through foundations should be placed upon the program of the next congress for consideration.

On the subject of technical and commercial working of inland waterways, the congress recommends uniform types of freight contracts and bills of lading and the establishment of agencies to arrange for cargoes and the making of contracts. It recommends the replacement of vessels of rectangular form by those of stream-line section, also the use of mechanical traction by means of electrically-propelled locomotives running on rails for all canals where the quantity of traffic warrants. It urges that tolls be established for the purposes of revenue based upon the value of the services rendered.

On the subject of the construction of port facilities exposed to the sea, the congress recommends that more systematic studies be carried on, or started simultaneously in different countries, with reference to the value of the strains on such structures due to waves and also the types of instruments most appropriate for their measurement. It recommends that care be taken to distinguish between the waves with orbitary movement and breakers.

The United States was represented at the congress by General Harry Taylor, formerly Chief of Engineers, U. S. Army, colonels Charles Keller, C. M. Townsend, J. Oaks and S. Crosby, Maj. J. Steese, John C. Hoyt, J. Hampton Moore and R. MacElwee.

Engineering Problems of Kansas Reviewed at Society Meeting

At the nineteenth annual meeting of the Kansas Engineering Society the reports of the various sections—(1) structures and materials, (2) transportation, (3) sanitation and water resources and (4) electrical, mechanical and mining—provided a review of the engineering problems now confronting the state.

A connected system of highways for Kansas was discussed by W. B. Buck, state highway engineer. Mr. Buck asked the society to endorse the governor's stand for a state system as against the piece-meal construction now being carried on by the counties. Irrigation, drainage and flood control are receiving considerable attention and a symposium on these subjects was announced for Feb. 23 and 24 at the University of Kansas where a number of prominent engineers will discuss plans for more efficient results. Other subjects touched upon included the necessity for a state building code, taxation of buses and the need for a survey of the state's construction material.

In a paper "Some Factors Affecting the Yield of Concrete," W. C. McNown, professor of highway engineering, University of Kansas, indicated the advances in concrete design which are not generally practiced in the state. These advances included (1) acceptance of water-cement ratio as a fact, (2) specification of concrete by strength instead of by arbitrary proportions, (3) acceptance as best of that sand which will permit a given consistency with the least amount of water, (4) and the use of course aggregates in mass concrete in larger sizes than ordinarily specified.

Kansas contractors have been slow to adopt these principles but a trend upward is noted.

Quebec to Aid New Railway

In the speech from the throne at the opening of the Quebec Legislature, the announcement was made that the government intended to provide a cash subsidy to aid in the building of a railway to form the link in the line around Lake St. John, such branch to run from St. Felicien to Herbertville Station, where it will link up with the present Canadian National Ry. line. It is understood this link will be built by the Canadian National Ry.

Personal Notes

RALPH STARRETT, vice-president of Starrett-Dilks Co., builders, Chicago, Ill., has retired from the company, and the name of the company has been changed to the Dilks Construction Co. Lorenzo C. Dilks is president; Elwood G. Glass, vice-president, and James G. Rigney, secretary and treasurer. The firms' headquarters are at 160 North La Salle St.

F. H. COTHRAN, formerly vice-president of the Quebec Development Co. and in charge of construction on the Saguenay River projects has been appointed chief engineer of the Piedmont and Northern Lines with office in the Johnston Building, Charlotte, N. C.

FRANK R. LAYNG, engineer of track, Bessemer & Lake Erie R.R., has been appointed assistant chief engineer, with office at Greenville, Pa.

L. A. PETERMAN has been placed in charge of lease inventory and valuation for the Marland Oil Co. of Texas, in the San Angelo District. Mr. Peterman has been on highway work, in Texas, for the past six years and was county highway engineer of Robertson County for the last three years of this period. He will be located at McCamey, Upton County, Texas, and will cover all counties for the Marland company west of San Angelo.

F. H. SMITH, former Douglas County highway engineer, has been appointed district highway engineer for southwest Nebraska to succeed A. T. Lobdell who has taken over the work as assistant state engineer. Mr. Smith will have headquarters at McCook, Neb.

F. E. COKER was appointed district highway engineer, ninth district, Harrison, Ark., effective Jan. 1, 1927. Mr. Coker is a graduate in civil engineering of the University of Arkansas, and has recently been employed in real-estate development in western North Carolina.

J. H. KIRKWOOD, county engineer of Grays Harbor County, at Montesano, Wash., has been reappointed for another two-year term.

WENDELL P. BROWN, of Cleveland, Ohio, has been selected to act as consulting engineer in connection with the erection of the memorial bridge over Black River, at Lorain, Ohio.

FRANK D. DANIELSON, village manager of Hinsdale, Ill., and an engineer, has resigned, after five years of service, to take a position with a private industrial concern.

FRANK J. ROSSI, for the past four years the deputy city engineer of Modesto, Calif., has been appointed city engineer and manager of the department of public works, succeeding F. W. MCCARTON, resigned.

CHARLES M. ADAMS, of Bellingham, Wash., former city engineer, and also former county engineer of Whatcom County, has accepted a two-year contract with the government of Santo Domingo, Haiti, as engineer for installation of sewer and water systems for the city of Santo Domingo that will cost about $2,500,000. Mr. Adams has been in public engineering work in Whatcom County for ten years.

ELY C. HUTCHINSON, since 1922 vice-president and general manager of the Pelton Water Wheel Co., San Francisco, has been appointed president and general manager of that organization. Mr. Hutchinson has been associated with the Pelton Water Wheel Co. since 1908 and in recent years has taken an active part in the development of many important water powers of the Pacific Coast.

W. HAROLD EVANS, until recently assistant engineer with C. C. Vermeule, consulting engineer of New York, is now connected with the Rockville Centre Blue Print, Inc., Rockville Centre, L. I. This organization will serve the engineers, architects and contractors of Long Island in the making of engineering prints.

BURTON LOWTHER, consulting engineer, Guardian Trust Biulding, Denver, Colo., has been retained by the city of Colorado Springs, to report on the sanitation of the municipal water supply.

FRANK B. NEWTON, division engineer for the Missouri State Highway Department, has tendered his resignation to the state commission effective March 1. His district comprises eleven counties in Southeast Missouri.

GEORGE F. WEIGHARDT, formerly highways engineer of Baltimore and also at one time assistant water engineer for the city, but more recently business manager for the Baltimore schools, has been appointed head of the Baltimore Bureau of Water Supply. In this position he succeeds V. BERNARD SIEMS, who resigned to form a business connection in New York.

S. L. Squiers, deputy minister of highways for the province of Ontario, Can., has resigned. He has been succeeded by Robert M. Smith, chief engineer of the department.

Obituary

THOMAS M. LANCASTER, city engineer for Bloomington, Ill., died in that city suddenly on Dec. 23 of heart disease.

IVAN BLOOD, former city engineer of Aberdeen, Wash., was killed instantly in an automobile accident on Dec. 13.

RALPH E. HAGEN, secretary of the Monighan Machine Co., Chicago, died Jan. 19, at the age of 31 years.

J. H. E. SECRETAN, one of the engineers who worked on the location and construction of the Canadian Pacific Ry. and later was chief engineer of the Manitoba and Northwestern Ry. and the Northwest Central Ry., died at Ottawa, Ontario, Dec. 22, age 73 years.

Engineering Societies

Calendar

Annual Meetings

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Quebec, Feb. 15-17, 1927.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, Trenton, N. J.; Annual Meeting, Atlantic City, N. J., Feb. 16-18, 1927.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual meeting, Chicago, Ill., Feb. 22-24, 1927.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago, Ill.; Annual Convention, Chicago, Ill., March 8-10, 1927.

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Meeting, Chicago, Ill., May 9-12, 1927.

The Engineers' Club of Los Angeles held its inaugural meeting on the evening of Jan. 18. About 300 were in attendance. In addition to announcement of details of organization there were short talks by several speakers including Charles H. Paul, Miami Conservancy District and Arthur P. Davis, East Bay Municipal Utilities District. The objects of the new club, according to the preamble of the constitution are as follows: "Cognizant of their public obligation and desiring to promote fellowship, engineers and allied professional men of the Southwest have banded themselves together as The Engineers' Club in order that they may take their proper place in the community and by common accord give expression to those things best expressed by the engineer and in order that they may derive mutual benefits through social contact and co-ordination of efforts."

The Engineers Club of Philadelphia, at its meeting Feb. 15, will hear a number of papers on subjects of particular interest to engineers of highways and city paving. Discussions will include methods for strengthening foundations, a survey of the situation in both New York and Philadelphia, quality control of concrete for paving and pavement foundations, etc. Two sessions will be held, one at 2 p.m. and one at 7 p.m.

The Rocky Mountain Section of the A.W.W.A. will hold a meeting at Denver, Feb. 7 and 8, 1927. Dana E. Kepner, state board of health, 420 State Office Bldg., Denver, Colo., is secretary.

The Construction Division Association (of the A.E.F.) held its eighth annual meeting in Chicago at the Hotel Morrison Jan. 14 and 15.

The Western Society of Engineers has on its program for Feb. 14 a paper on "Beauty in Engineering Structures" by Irving K. Pond, architect.

The New Jersey Association of County Engineers at the annual meeting held recently at Trenton, N. J., elected the following officers: President, William A. Steckel, Newark; vice-president, Harry W. Vetter, Belvidere, N. J.; treasurer, J. M. Abbott, Toms River, N. J.; and secretary, Harry F. Harris, Mercer County engineer, Trenton, N. J.

Construction Equipment and Materials

A Section Devoted to What the Manufacturer is Doing for the Engineer and Contractor

Crushed Stone Association Has Annual Meeting

The tenth annual convention of the National Crushed Stone Association was held in Detroit, Mich., Jan. 17-20. Coincidental with the holding of technical sessions was the manufacturers exhibition, 52 exhibitors occupying 64 booths, a considerable increase over the 1926 convention.

Of chief technical interest were the following papers:

"Where Progress Lies in the Crushed Stone Industry," by A. T. Goldbeck, director, bureau of engineering, National Crushed Stone Association; "Crushed Stone for Sewage Disposal and Water Purification Work," by William E. Stanley, Pearse, Greeley & Hansen, Chicago; "The Use of Crushed Stone in Intermediate Types of Road Construction," by C. N. Conner, chairman, low cost improved road investigation, Highway Research Board; "The Super-Highway and Its Part in Detroit's Master Plan," by Col. Sidney D. Waldon, chairman, Detroit Rapid Transit Commission; "Bituminous Road Construction," by R. W. Coburn, construction engineer, Department of Public Works, Boston; "Some Modern Developments in Bituminous Road Construction and Maintenance," by K. E. McConnaughay, Hayes Construction Co., Indianapolis; "Bituminous Macadam Construction," by G. H. Henderson, chief engineer, State Board of Public Roads, Rhode Island; "Stone Dust, Its Use and Preparation," by W. M. Weigel, mineral technologist, Missouri Pacific R.R.; "The Value of a Transport Survey," by G. F. Schlesinger, director of highways and public works, Columbus, Ohio; "Personality of Highway Safety," by Charles M. Upham, managing director, American Road Builders' Association; "The Use of Crushed Stone in the Manufacture of Concrete Products," by W. D. M. Allan, Portland Cement Association; "Commercial Sizes of Broken Stone," by F. H. Jackson, engineer of tests, U. S. Bureau of Public Roads, Washington; "Earth Vibrations Caused by Quarry Blasting and Their Effects on Structures," by Prof. Edward H. Rockwell, Rutgers University, New Brunswick, N. J.; "Transportation Preparedness," by W. J. McGarry, American Railway Association, Washington, and "Field Testing of Concrete for Concrete Roads," H. F. Clemmer, Solvay Sales Corporation, New York City.

Officers elected for the ensuing year are: President, Otho M. Graves; secretary, J. R. Boyd; treasurer, James Savage, and director of the Bureau of Engineering, A. T. Goldbeck.

A number of sight seeing trips and social features were included in the program.

Atlas Shores Now Manufactured on Pacific Coast

To avoid the long freight haul and to save the contractors along the Pacific Coast the high cost of transportation that all freight originating east of the Mississippi has to bear, arrangements have been completed by the Roos-Meyer Hecht Co., Cincinnati, Ohio, originators, patentees and manufacturers of Atlas adjustable shores, with the W. R. Ames Co., 450 Irwin St., San Francisco, Calif., to permit the latter company to manufacture and distribute the Atlas adjustable shore in the Pacific Coast territory.

Concrete Road Yardage

For December, 1926, the square yardage included in concrete pavement contract awards, according to the Portland Cement Association, were: 3,517,871 for roads; 1,946,222 for streets; and 1,332,851 for alleys; or a total for the month of 6,796,944 sq.yd.

The accompanying table summarizes the statistics for the past year:

SQUARE YARDS OF CONCRETE PAVEMENT AWARDED DURING 1926

Month	Roads	Streets	Alleys	Total All Classes
Jan.	2,161,415	1,410,201	57,218	2,628,834
Feb.	2,726,611	2,010,941	274,836	5,012,388
March	4,662,885	3,050,630	224,879	7,938,394
April	8,758,195	4,324,729	479,763	13,562,687
May	8,910,678	4,619,195	507,250	14,037,123
June	10 973,452	5,999,859	524,572	17,317,883
July	5,662,841	4,865,421	327,313	10,855,575
Aug.	6,594,150	6,293,849	360,991	13,248,990
Sept.	3,736,005	4,342,265	299,350	8,377,620
Oct.	4,223,517	2,967,800	336,451	7,527,768
Nov.	3,230,838	2,137,223	226,860	5,594,921
Dec.	3,517,871	1,946,222	1,332,851	6,796,944
Totals	64,978,458	43,968,335	4,952,334	113,899,127

Southwest Road Show and School to Be Held at Wichita

The second annual road show and school will be held at Wichita, Kan., Feb. 22-25. In addition to extensive exhibits by manufacturers and distributors of all types of road building materials and equipment, there will be a showing of the complete exhibit of the Bureau of Public Roads, American Association of State Highway Officials and displays from several states.

A four-day program has been arranged which includes speakers experienced in lines of highway activities from all sections of the United States. This program is in charge of the engineering division of the Kansas State Agricultural College and the Kansas Highway Commission.

Among the speakers will be E. W. James, chief of the division of design, U. S. Bureau of Public Roads; A. R. Losh, district engineer, U. S. Bureau of Public Roads; J. T. Donaghey, former highway engineer of Wisconsin; H. E. Surman, engineer of design, Illinois Division of Highways; H. F. Clemmer, Wing & Evans, New York; Prof. W. C. McNown, Kansas University; Prof. L. E. Conrad, Kansas State Agricultural College and John M. Malang, Joplin, Mo.

These talks will be supplemented by motion pictures and illustrated lectures of methods and equipment for highway construction and maintenance.

Business Notes

CATERPILLAR TRACTOR CO., Peoria, Ill., has just announced the opening of a district sales office and distributing warehouse at Albany, N. Y.

REE CORP. has been formed to handle the Ahlers concrete strength regulator with John G. Ahlers as president. The officers of the new company are practically the same as for the Barney-Ahlers Construction Co., New York City.

MUNDY SALES CORPORATION announces the following appointments of new distributors: W. H. Anderson Tool & Supply Co., Grand Rapids, Mich.; Cyril J. Burke, Detroit, Michigan.; Cunningham-Ortmayer Co., Milwaukee, Wis., and R. W. Simpson, Cedar Rapids, Iowa.

W. H. BRANDT, advertising manager, Chain Belt Co., Milwaukee, has been appointed assistant secretary, succeeding George M. Dyke, who has gone to Cleveland to assume the duties of secretary of the Stearns Conveyor Co., which is now owned by the Chain Belt Co. A. R. Abelt is now advertising manager.

WORTHINGTON PUMP & MACHINERY CORPORATION has purchased the Harris Air Pump Co. of Indianapolis, manufacturers of air-lift systems and air-lift pumps. The purchase was outright and includes patents, drawings, patterns and good-will. This new acquisition allows Worthington to offer complete well equipment, including compressor, produced in its own plants.

New Publications

Locomotive Cranes and Platform Derricks—The American Hoist & Derrick Co., St. Paul, Minn., has issued an 8-page pamphlet on the special features of its locomotive cranes; also a 4-page pamphlet on pillar and stiff-leg derricks for use on freight platforms.

Highway Signals — INTERFLASH SIGNAL CORP., New York City, has issued a pamphlet devoted to its pedestal type signals described in *Engineering News-Record*, November 18, 1916, p. 52. Illustrations are given of the one-way, four-way, and eight-way lanterns used on top of the pedestals as well as of the symbols and word signs as worked out by the Joint Board on Interstate

Highways and approved by the Association of State Highway Officials, the National Conference on Street and Highway Safety and the Bureau of Public Roads. These standard signs are visible not only by day but also at night by means of the acetylene lighting equipment.

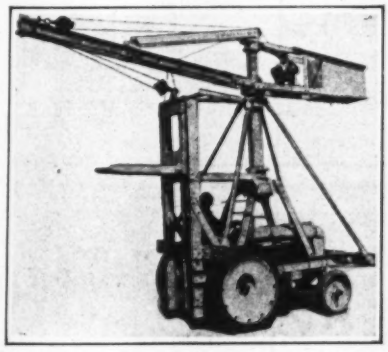
Lime Filler for Asphalt Pavements—NATIONAL LIME ASSOCIATION has devoted its most recent bulletin, No. 318, to the value of hydrated lime as a filler in asphalt paving mixes. It is the result of research work conducted by the Asphalt Association. The data given indicate that the use of hydrated lime will make possible the use of many fine sands now excluded by standard specifications and also indicate that hydrated lime used as a filler will reduce the danger of cracking in cold weather.

Winter Construction Tools—AEROIL BURNER CO., INC., Union City, N. J., devotes bulletin No. 52 to descriptions, photos and prices of its concrete heaters, thawing torches, motor heating pans, salamanders, water heaters, and furnace burners.

New Developments

Crane and Elevator Unit Built Around Fordson Tractor

A revolving crane structure mounted on a Fordson tractor and having a material elevator platform attached to the rear end of the tractor is being introduced by the Otis Engine Corp., 247 Park Ave., New York City, and is known as a revolving hammer-head crane. The illustration shows the machine with the drop line of the crane being used to operate the elevator platform. The drop line when disengaged from the elevator is available for any kind of crane-handling work. The load capacity of the crane is 1 ton at a 9-ft. radius. The boom height above the ground is normally 15 ft., but it can be raised to 18 ft. when needed or lowered to 8 ft. when necessary. The



hoist mechanism is inclosed with the engine housing. All wearing parts are mounted on ball bearings, running in a bath of oil. Single line speeds are 30 to 80 ft. per minute.

The elevator platform is designed to handle loads that pile well but are not suitable to sling. Such loads are usually piled on platforms about 3x5 ft. in plan and they thus can be easily handled. The platform is hinged so that it pulls back when not in use.

The machine is built throughout of steel with a total weight, including tractor, of 6 tons.

Road Machine Embodies Tractor Roller, Scarifier and Grader

A ruggedly built road machine is being manufactured by the Gray Giant Co., San Pedro, Calif., which is a development arising from the company's farm tractor which it has been manufacturing for the past 12 years. The machine is designed to handle all maintenance on the various types of macadam roadway and also to provide a scarifier and regrading unit for granite and sand-clay roads. The unit is 32 ft. over all and embodies a roller, a tractor, a scarifier and a grader. The grader is attached to the rear platform of the tractor as shown in the illustration. This hook-up is claimed to utilize the weight of the rear end of the tractor in holding down the grader on the heaviest kind of work.

The outstanding feature of the machine is its wide drum roller, 56 in. in width, giving compression of 350 lb. per lin. in. and rated at 12 tons. The large bearing surface of this wide drum is claimed to give the machine a considerable reserve of traction so that by the insertion of traction lugs, the full power of the 60-hp. Waukesha motor can be utilized. The scarifier built behind the roller has a capacity of 25 teeth. It is controlled by a worm operated by the driver, leaving the grader operator free to attend only to the grading. Suitable teeth, quickly changed without the use of a wrench, are provided for varying work.

Manufacturers and Trade Associations

Calendar

Annual Meetings

HOLLOW BUILDING TILE ASSOCIATION, Chicago; Annual meeting, Chicago, Feb. 10 and 11.

COMMON BRICK MANUFACTURERS ASSOCIATION, Cleveland; Annual meeting, Chicago, Feb. 21-26, 1927.

NATIONAL BATTERY MANUFACTURERS' ASSOCIATION, New York; Annual meeting, Philadelphia, March 11 and 12, 1927.

CONCRETE REINFORCING STEEL INSTITUTE, Chicago; Annual Meeting, White Sulphur Springs, West Va., March 21-23.

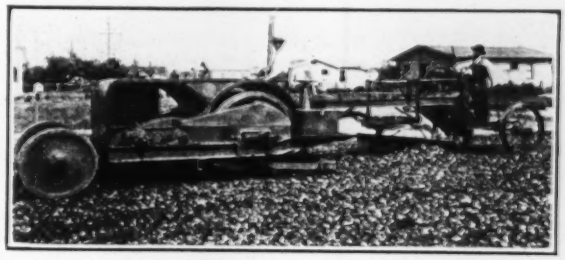
HYDRAULIC SOCIETY, New York; Annual meeting Chicago, March 25, 1927.

AMERICAN WELDING SOCIETY, New York; Annual meeting, New York City, April 27-29.

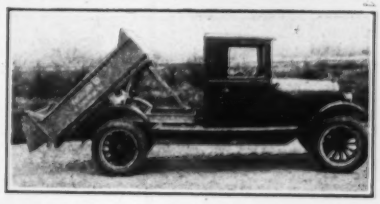
WATERWORKS MANUFACTURERS ASSOCIATION, New York; Annual meeting, Chicago, June 6-10.

Gravity Dump Body for Long Frame Trucks

On many trucks where the frame extends considerably beyond the rear axle, gravity dump bodies have not been applicable because of the difficulty of getting a low enough loading height. For this reason it is said that a majority of these trucks are using hand hoist, mechanical or hydraulic hoist



bodies. Anthony Co., Inc., Streator, Ill., has, however, now developed a roller rocker body which has the center of gravity about 12 in. ahead of the rear axle. When loaded, the body is heavier at the back than at the front and needs only to be tripped by the lever in the cab to roll back on the rocker and dump clear of the frame. Another pull of the lever causes the body to automatically return to a locking posi-



tion. The lever merely trips the stiff leg shown supporting the body in the illustration. The company states that with this body long frame trucks can be used for concrete mixer work where a quick acting body is necessary.

Fordson Locomotive Built In 6, 7 and 8-Ton Sizes

Especially designed for handling one or more standard freight cars, a locomotive built around the Fordson tractor and available in three sizes of 6, 7 and 8 tons, is a new product of the Brookville Locomotive Co., Brookville, Pa. A feature of the locomotive is a patented reverse mechanism entirely independent of the Fordson tractor so that the standard Fordson speeds are obtained in reverse, the same as forward. This gives an equal pulling power in both directions. The range of three speeds can be varied from low at 1.125 m.p.h. to high speed at 8.437 m.p.m.

Engineering News-Record Statistics of the Construction Industry

Feb. 3, 1927 — *in the United States* — Vol. 98, No. 5

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

January, 1926 to Date

February, 1927	**210.15**
January, 1927	211.50
February, 1926	206.55
Peak, June, 1920	273.80
1913	100.00

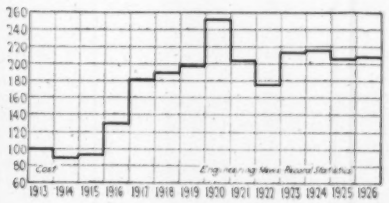
1926

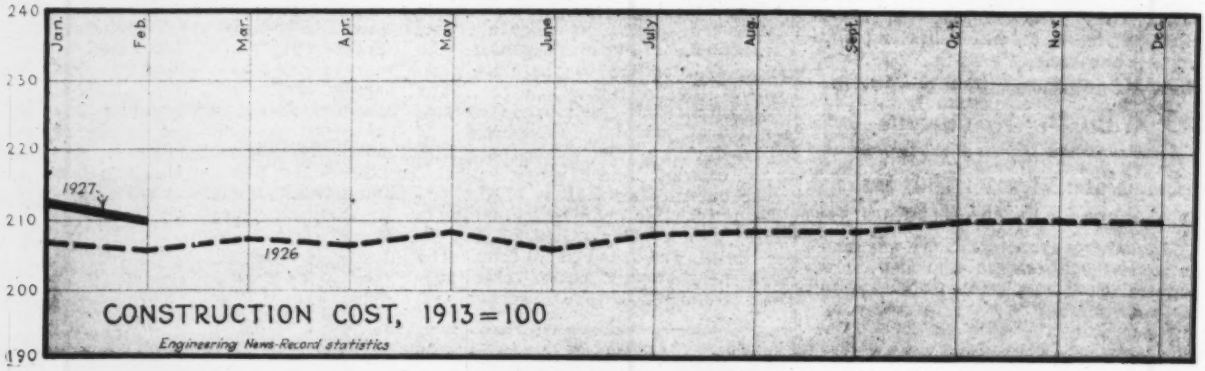
Jan.	207.15	May	207.30	Sept.	208.30
Feb.	206.55	June	204.80	Oct.	209.80
Mar.	207.65	July	207.80	Nov.	210.80
April	207.05	Aug.	208.30	Dec.	210.80

ENGINEERING NEWS-RECORD'S Construction Cost Index Number is 0.6 per cent below January, 1927. The decrease is due mainly to lower prices for steel, lumber and cement. Labor costs hold to recent high levels with few prospects of decline. The average rate for common laborers is 55½c. per hr., against 54c. at this time last year. Thus, general construction cost is 1.7 per cent above February, 1926, 23 per cent under the peak and 110 per cent above 1913.

YEARLY

1913 to 1926





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

January, 1926 to January, 1927

January, 1927	**187**
December, 1926	188
January, 1926	198
Peak, August, 1925	266
1913	100

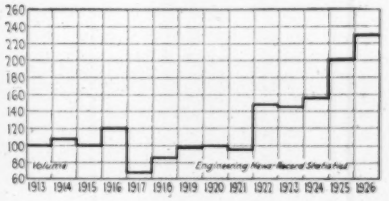
1926

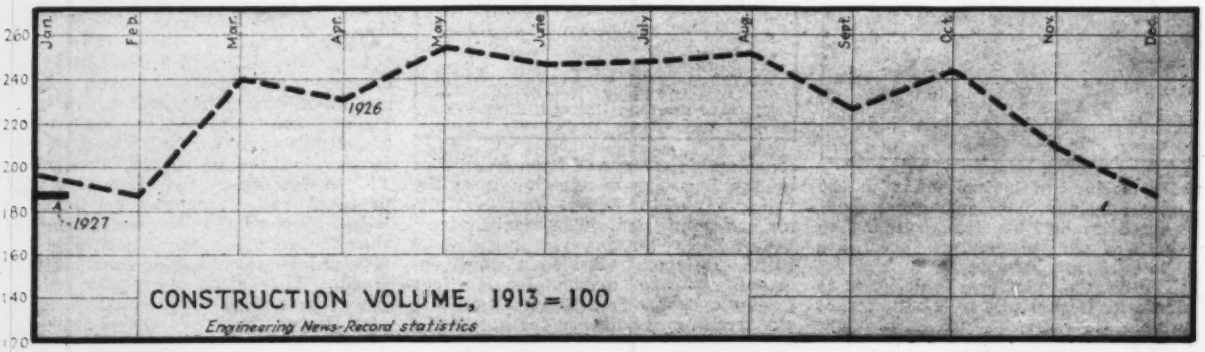
Jan.	198	May	254	Sept.	227
Feb.	187	June	246	October	244
Mar.	243	July	248	Nov.	211
April	233	Aug.	252	Dec.	188

ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 187 for the month of January and 228 for the whole of 1926, as against 100 for 1913. This means that the actual volume of contract letting in 1926 (not the mere money-value of the contracts let that year) is 128 per cent above the volume for 1913. The monthly volume number, 187 for January, 1927, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

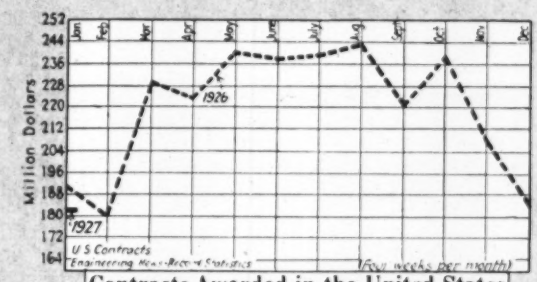
YEARLY

1913 to 1926

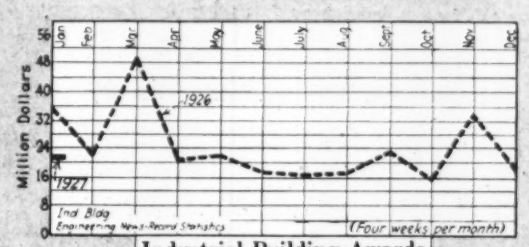




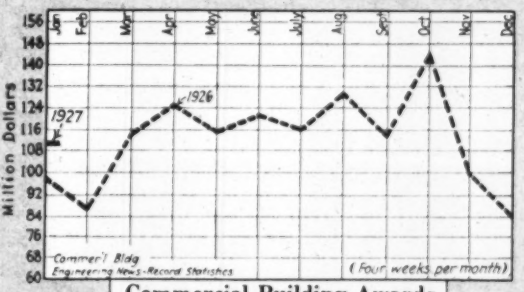
Monthly Statistics of the Construction Industry



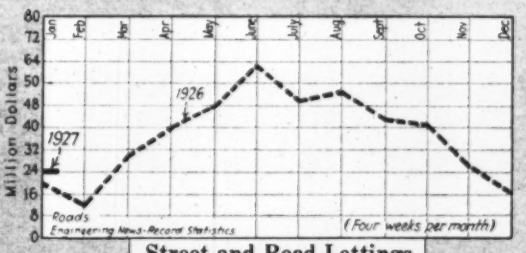
Contracts Awarded in the United States
Reported by E. N.-R.



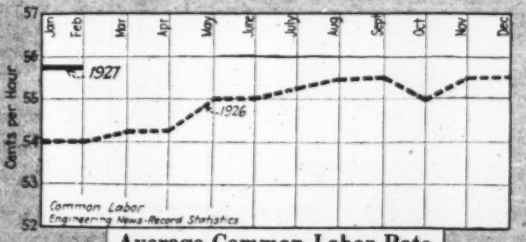
Industrial Building Awards
$40,000 and Over



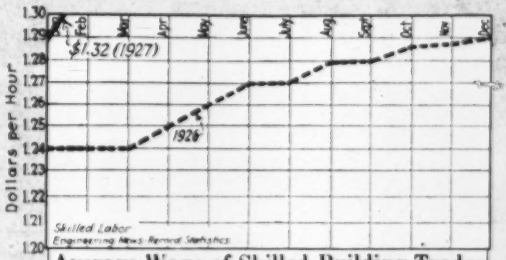
Commercial Building Awards
$150,000 and Over



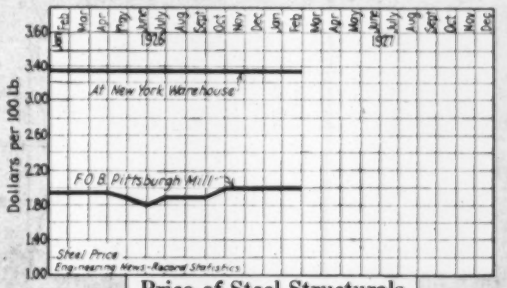
Street and Road Lettings
$25,000 and Over



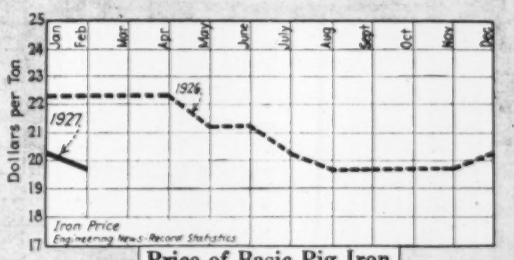
Average Common Labor Rate
Pick and Shovel Men



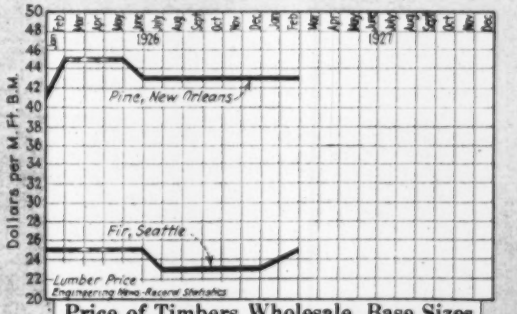
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



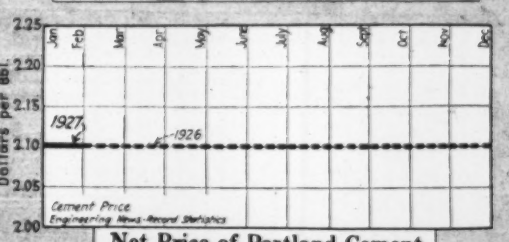
Price of Steel Structurals
Shapes 3-in; Plates ¼-in.



Price of Basic Pig Iron
F.o.b. Pittsburgh

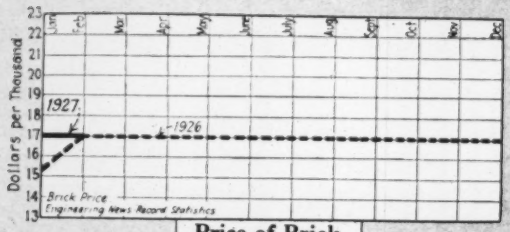


Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors

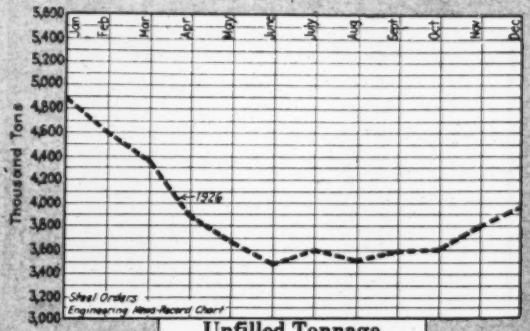


Net Price of Portland Cement
Car Lots F.o.b. Chicago

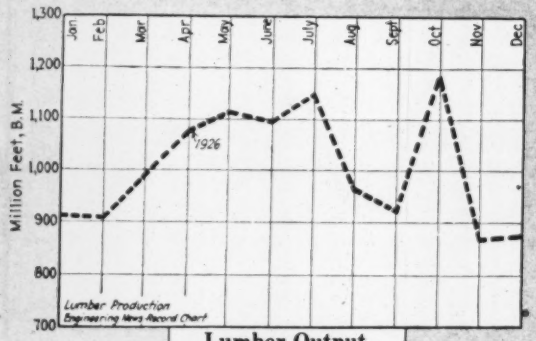
Monthly Statistics of the Construction Industry



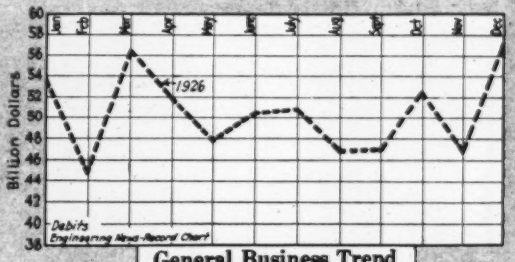
Price of Brick
At Dock, New York



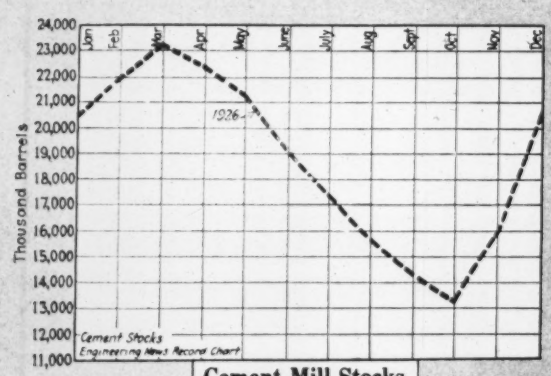
Unfilled Tonnage
On Books of U. S. Steel Corp.



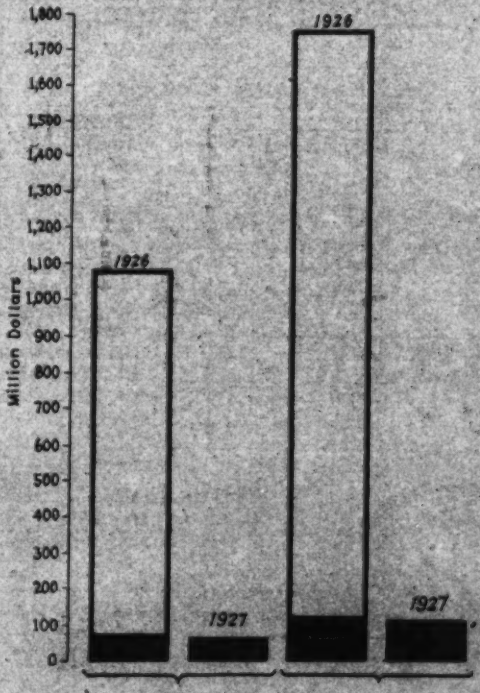
Lumber Output
Nat. Lumber Mfrs. Assn.



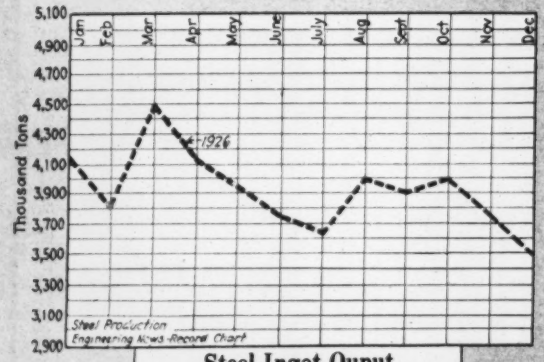
General Business Trend
Bank Debits—Federal Reserve



Cement Mill Stocks
Bureau of Mines



Public—Contracts—Private
Jan. 1 to date ——
Reported by E. N.-R.



Steel Ingot Ouput
Gross Tons; Am. Iron and Steel Inst.

January Construction Slightly Under Same Month Last Year

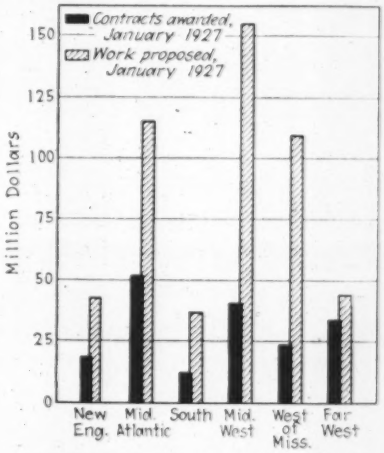
Gains Realized In Streets and Roads, Commercial and Public Buildings and Government Work

CONTRACT value of heavy engineering construction for the United States in January was 5 per cent below that of the corresponding period last year, according to *Engineering News-Record* statistics. Work in the proposed stage shows even greater recession, amounting almost to an 18 per cent decline from the January, 1926 level. The first month of 1926 started that year off with substantial gains over the same period in 1925 in both contemplated work and lettings.

Despite this rather unfavorable start, the great bulk of 1926 proposed projects should result in 1927 contracts, less than 3 per cent under last year's volume, if not equal to it.

January showed definite gains over the same month in 1926, in several classes of work, namely, streets and roads, commercial and public buildings, Federal Government construction and various privately owned unclassified jobs.

The contract totals in the accompanying table, although covering the entire country on heavy engineering construction, are limited to certain minimum values, according to classification. By that is meant, nothing under $15,000 on water works construction, excavating, drainage, irrigation, levee, river and harbor work. The minimum is placed at $25,000 for public works other than those just mentioned. Industrial buildings under $40,000 are considered too small and commercial, educational, religious or other buildings below $150,000 are omitted.



CONTEMPLATED WORK AS IT LOOMS UP BEHIND CONTRACTS LET

The accompanying diagram shows the volume of proposed work in the various sections of the country as related to value of contracts already awarded.

Indications are that the lead, now held by the Middle Atlantic group, will soon pass over to the Middle West, provided of course, that too many of these proposed projects are not abandoned.

The territorial divisions of the United States mentioned in the table, contain the following states: *New England*—Me., N. H., Vt., Mass., R. I., Conn. *Middle Atlantic*—N. Y., N. J., Penn., Del., Md., Dist. of Columbia. *South*—Va., W. Va., N. C., S. C., Ga., Fla., Ala., Miss., La., Tenn., Ky. *Middle West*—Ohio, Ind., Mich., Ill., Wis. *West of Mississippi*—Ark., Colo., Ia., Kan., Minn., Mont., Mo., N. M., N. D., Neb., Okla., S. D., Tex., Wyo. *Far West*—Idaho, Utah, Nev., Ariz., Wash., Ore., Calif.

Following are the January totals of contracts awarded on engineering construction, for the entire country, 1913 to 1927, inclusive:

1913	$43,487,000*	1921	$55,578,000
1914	36,447,000*	1922	78,550,000
1915	19,274,000	1923	147,678,000
1916	52,085,000	1924	160,478,000*
1917	53,714,000	1925	171,780,000*
1918	60,541,000*	1926	190,647,000
1919	43,782,000*	1927	181,740,000
1920	180,320,000*		

* Five issues of E. N-R.

Value of Contracts Let in the United States and Canada During January, 1927

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Canada
Waterworks	$15,000	$145,000	$124,000	$390,000	$1,029,000	$977,000	**$2,680,000**	$109,000
Sewers	63,000	835,000	294,000	1,548,000	563,000	1,394,000	**4,697,000**	457,000
Bridges	129,000	1,224,000	1,657,000	337,000	673,000	141,000	**4,061,000**	
Excavation, drainage, irrigation	15,000	34,000		29,000	177,000	348,000	**603,000**	
Streets and roads	422,000	6,058,000	6,383,000	2,178,000	5,706,000	3,486,000	**24,233,000**	280,000
Industrial buildings	1,055,000	5,280,000	325,000	3,403,000	2,470,000	9,045,000	**21,578,000**	125,000
Commercial buildings	15,760,000	36,136,000	3,378,000	31,330,000	9,775,000	14,906,000	**111,285,000**	700,000
Federal government	191,000	651,000	396,000	567,000	1,420,000	600,000	**3,825,000**	
Unclassified	875,000	1,018,000	159,000	322,000	2,628,000	3,676,000	**8,678,000**	3,357,000
January, 1927	**$18,525,000**	**$51,381,000**	**$12,716,000**	**$40,104,000**	**$24,441,000**	**$34,573,000**	**$181,740,000**	$5,028,000
December, 1926	19,746,000	65,051,000	19,572,000	57,709,000	30,858,000	36,667,000	229,603,000	3,647,000
January, 1926	7,972,000	71,085,000	24,855,000	40,901,000	25,821,000	20,013,000	190,647,000	7,384,000

Labor Rates and Conditions Throughout the Country

Five-Day Week Idea Continues to Gain Momentum

THE movement for the forty-hour week in the building trades, which started simultaneously in all sections of the country a month or so ago, has had added to it, during the last thirty days, the vigorous support of skilled mechanics in Newark, N. J., Pittsburgh, Pa., and Denver, Colo.

In Newark, N. J., where painters and decorators adopted the five-day system several years ago, as a sanitary measure, other building craftsmen are preparing to institute the same plan, begining with the coming summer season.

Denver carpenters and painters proposed the adoption of the five-day system and have apparently gained the support of the employers, provided, as the latter indicate, that it is not just another plan to raise labor costs.

Organized steam fitters in Pittsburgh started their fight for the forty-hour plan Jan. 18, and will, no doubt, be closely followed by the structural ironworkers, cement finishers and hoisting engineers.

San Francisco Carpenters Strike Ended

After nine months of violent fighting over open-shop conditions in the carpenter trade, the San Francisco craftsmen have returned to work without any apparent gains having been realized. It may develop, however, that the present agreement is merely a truce and that union men will, at some future time, present demands for operations on a strictly closed-shop basis.

In addition to the tabulation of current rates in the key trades, published in this section in the first issue of each month, the following schedule of wages in some of the other crafts is given:

NEW YORK CITY

Trade	Rate per Day
Art glass workers	$10.00
Asbestos workers and insulators	12.00
Asbestos workers' helpers	9.00
Blacksmiths	12.00
Blacksmiths' helpers	9.00
Bluestone cutters	12.00
Bluestone cutters' helpers	9.00
Boilermakers	12.00
Boilersmakers' helpers	10.50
Cabinet makers (shop)	12.00
Cement masons	12.00
Cement and concrete laborers	8.00@8.50
Composition roofers and waterproofers	11.00
Derrickmen and riggers	11.00
Dock builders and pier carpenters	12.00
Electrical workers	12.00
Electrical workers' helpers	8.00
Elevator constructors	12.00
Elevator constructors' helpers	9.00
Engineers:	
House cars	13.50
Stationary	11.00
Dockbuilders (per week)	71.50
Foundation (per week)	71.50
Excavating (per week)	63.25

(*Continued on p. 218*)

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	+$1.40	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.62½@1.75	1.00@1.10	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	1.00@1.50	.40@1.05	+ 75@1.25	50@.75	.....	.75@1.75	+ .25@.40
Boston	1.40	1.25	1.25	.79	1.15	1.25	.45@.74
Cincinnati	1.50	1.31¼	1.31¼	.95	1.31¼	1.31¼	.45@.58
Chicago	1.62½	1.10@1.50	1.00@1.50	.90	1.50	1.50	.90
Cleveland	1.50	1.25	1.30	.87½@1.10	1.10	1.50	.87½
Dallas	1.62½	1.12½	1.00	.40@.75	1.00	1.00	.30@.50
Denver	1.62½	1.25	1.12½@1.18¾	.81¼@.87½	1.00	1.15¾	.40@.55
Detroit	1.50	.90@1.15	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City, Mo	1.50	+1.37½	1.25	.90	+1.25	1.25	.35@.75
Los Angeles	1.37½	1.00	1.00	.87½	+.87½	1.00	.50
Minneapolis	1.25	.87½@95	.87½	.75	....	1.00	.45@.60
Montreal	+1.25	.75	.60	.40	.50	.75	— 25
New Orleans	1.50	.90	1.00	.75	.80	1.25	.30@.40
New York	1.75	1.50	1.75	1.12½	1.00@1.12½	1.75	.90⅛
Philadelphia	1.50@1.62½	1.12½@1.25	1.02½	1.12½	1.00	1.12½@1.25	.45@.50
Pittsburgh	1.62½	1.50	1.37½@1.50	1.12½	....	1.50	.80
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.25	1.50	.45@.75
San Francisco	+1.37½	+1.12½	+1.00@1.06¼	+ .87½	+1.12½	+1.37½	+.50@.60
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.62½

(Concluded from p. 217)

Trade	Rate Per Day
Glaziers	$12.00
Granite cutters (yard)	11.00
Housesmiths, finishers	12.00
Housesmiths, finishers' helpers	9.00
House shorers and sheathpilers	12.00
House shorers and sheathpilers' helpers	9.00
Machinists	12.00
Machinists' helpers	9.00
Marble cutters and setters	12.00
Marble carvers	13.00
Marble polishers, bed rubbers and sawyers	11.00
Marble workers' helpers	9.50
Metallic lathers	12.00
Millwrights	$12.00
Mosaic and terrazzo workers	12.00
Mosaic and terrazzo workers' helpers	9.00
Painters and decorators	12.00
Pipefitters (open cut)	?1.00
Pipefitters (compressed air)	12.00
Plasterers	14.00
Plumbers and gasfitters	12.00
Roofers and sheet metal workers	12.00
Slate and tile roofers	13.50
Steam and hot water fitters	12.00
Steam and hot water fitters' helpers	9.00
Stone cutters	12.00
Stone carvers	$13.00
Stone planermen	11.00
Stone bed rubbers (large side)	10.50
Stone bed rubbers (rear side)	9.50
Stone circular, diamond and gang sawyers	8.95
Stone crane operators	8.60
Stone hand rubbers and helpers	8.30
Stone masons	14.00
Stone masons' helpers	9.00
Stone setters	14.00
Tile layers	12.00
Tile layers' helpers	9.30
Upholsterers	11.75

Monthly Prices of Construction Materials

Declines Predominate

REDUCTIONS now going into effect in prices of basic construction materials, represent more than the seasonal movement in the market for this particular group.

These declines, however slight, will serve principally to restore to the construction industry some of the investment money that may have been frightened away by recent grave, but probably well founded, warnings regarding over-building in certain types of structures in certain localities.

The present downward tendency, viewed in a nationwide sense, involves pig-iron, scrap, cast-iron pipe, cement, steel structurals, reinforcing material, rivets, lumber, steel sheets, brick, and lime. Slight fluctuations, mostly declines, are reported in sewer pipe in some sections.

The specific cause of the foregoing price recessions is simply more than seasonal slump in demand, accompanied by plentiful supply of the materials affected.

It will be noted in the tables on the following four pages that, compared with a month ago, prices are higher in some of the items listed. This refers principally to linseed oil, manila rope, curbing, asphalt and re-rolled rails.

In the case of the advances referred to, buying, though not especially active, is no more than met by present production and shipments.

Output of cement and steel are in substantially large volume, compared with other years. The same is true of common building brick but does not apply to the paving varieties.

Lumber cutting, however, is falling off, which would indicate that price reductions will probably not be so marked in this material as in others where no definite restriction of production has been effected.

CURRENT PRICES COMPARED WITH YEAR AGO AND FEB. 1925

Material	Current	Month Ago	Feb. 1, 1926	Feb. 1, 1925
Steel beams, Pittsburgh mill, carlots, per 100 lb	$1.90@$2.00	$2.00	$1.90@$2.00	$2.00@$2.10
Reinforcing bars, billet steel, Pittsburgh mill, carlots, per 100 lb	1.90@ 2.00	2.00	2.00	2.10@ 2.20
Pine timbers, 3x12 to 12x12, 20 ft., wholesale, New York, per M. ft. b.m.	57.00	57.50	57.00	55.00
Railway ties, white oak, 6x8, 8ft., Chicago per tie	1.45	1.45	1.35	1.60
C.-I. pipe, 6-in., carlots, f.o.b. Birmingham, per net ton	37.00	38.00	41.00@42.00	48.00@50.00
Sewer pipe, 6-in., carlots, f.o.b. Pittsburgh, per ft.	0.11	0.11	0.1485	0.135
Asphalt, bulk, f.o.b. Oleum, Calif., per ton	12.00	12.00	12.00	12.00
Granite paving blocks, 5-in., New York, per M	142.40	142.40	147.00	135.00@142.00
Lime, common lump, at warehouse, 280 lb. net, per bbl	2.50@ 3.00	2.50@ 3.00	3.00	3.10
Hollow tile, 10x12x12, carlots, f.o.b. Perth Amboy, N. J., per block	0.252	0.252	0.252	0.2388
Rivets, structural, ¾-in., f.o.b. Pittsburgh, per 100 lb	2.30@ 2.60	2.60	2.60	2.60
Wire nails, f.o.b. Pittsburgh, per 100 lb. kg.	2.65	2.65	2.65	2.85
Steel sheets, galv., No. 24, f.o.b. Pittsburgh, per 100 lb	3.75@ 3.85	3.85@ 3.95	4.15	4.30@ 4.40
Linseed oil, raw, 5-bbl. lots, f.o.b. Minneapolis, per 7½-lb. gal	0.96	0.90	0.99½	1.27
Pine piles, with bark on, f.o.b. New York, 12-in. butt, 6-in. point, 30 to 50 ft., by barge, per lin. ft	0.145	0.145	0.145	0.145
Manila rope, ¾-in., 1200 ft. coils, San Francisco, per lb	0.225	0.22	0.25	0.23
Dynamite, 40 per cent gelatin, special, case lots, New York, per lb	0.265	0.265	0.265	0.27

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

CINCINNATI	Feb 3	One Year Ago
No. 2 Southern (silicon 2.25@2.75)	*$22.19*	$24.05
Northern Basic	20.89	24.27
No. 2 Southern Ohio (silicon 1.75@2.25)	21.39	24.27
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	26.37	28.37
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	*18.50*	22.00@23.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	*$23.26*	24.16
Virginia No. 2 (silicon 2.25@2.75)	*28.17*	29.17
Basic	*21.76*	23.16
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	21.00	23.00
No. 2 Foundry Southern (silicon 2.25@2.75)	24.55	26.55
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	*20.26*	22.27
Basic	*19.76*	22.27
Bessemer	21.26	22.27

SCRAP—The prices following are f.o.b. per net ton paid by dealers:

	New York*	Chicago	Birmingham
No. 1 railroad wrought	$13.00@$14.00	**$12.75@$13.25**	$12.00@$13.00
Stove plate	9.25@ *11.00*	**14.00@ 14.50**	14.00@ 14.50
No. 1 machinery cast	*15.00*@ 16.00	16.00@ 16.50	17.00@ 17.50
Machine shop turnings	*8.75*@ 9.25	6.00@ 6.50	8.00@ 8.50
Cast borings	*8.75*@ 9.25	**9.25@ 9.75**	8.00@ 9.00
Railroad malleable	*14.50*@ *15.00*	14.25@ 14.75	16.00@ 17.00
Re-rolling rails	*12.25*@ 12.75	**14.50@ 15.00**	15.00@ 16.00
Re-laying rails	23.00@ 24.00		21.00@ 22.00
Heavy melting steel	*9.00*@ *12.25*	**12.00@ 12.50**	13.00@ 14.00

*Gross ton.

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Feb. 3	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	.....
Standard openhearth rails	43.00	43.00	43.00	43.00	$51.00
Light rails, 8 to 10 lb.	.....	.....	34@36	1.80@1.90*	2.05-2.15*
Light rails, 12 to 14 lb.	.....	.....	34@36	1.80@1.90*	1.88-1.98*
Light rails, 25 to 45 lb.	36.00	36@38	34@36	1.80@1.90*	1.84-1.94*
Re-rolled rails	**30@32**	30@34	30.00	34@36	.....

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, white oak, plain	$1.45	$1.83
Chicago, empty cell creosoted	1.85	2.45
Chicago, zinc treated	1.65	2.15
San Francisco, green Douglas fir	.84	1.14
San Francisco, empty cell creosoted, Douglas fir	1.70	2.25
St. Louis, white oak, plain	1.20	1.45
St. Louis, zinc treated	1.60	1.85
St. Louis, red oak, plain	1.10	1.35
St. Louis, sap pine-cypress	.95	1.20
Birmingham, white oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Feb. 3	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in and larger	$2.80@$2.90	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90@4.25	3.90@4.25	4.55	4.60	5.85	3.90
Standard section angle bars	2.85	2.75	3.40	3.75	3.60	4.15

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1½	30	12

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

STEEL PIPE—From warehouses at the places named the following discounts hold for welded steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	54%	62%	49%
2½ to 6 in. lap welded	48%	51%	59%	46%
	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	41%	50½%	36%
2½ to 6 in. lap welded	35%	38%	47½%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36 −5% off.

CAST-IRON PIPE—The following are prices per net ton for Class B and heavier in carload lots:

	Birmingham	Burlington, N. J.	New York Feb. 3	New York One Year Ago
4 in.	*$41.00*	*$49.00*	*$51.60*	$54.60@56.60
6 in. and over	*37.00*	*45.00*	*47.60*	50.60@52.60
	Pittsburgh	Chicago	St. Louis	San Francisco
4 in.	*$49.60*	*$49.20*	*$47.60*	*$51.00*
6 in. and over	*45.60*	*45.20*	*43.60*	*47.00*

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

Size, In.	New York Feb. 3	New York One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$45.00	$48.00	$40.00	$45.00	.....	$73.00
4	55.00	60.00	40.00	56.00	$76.50	110.00
5	.....	.....	.....	80.00	97.75	118.00
6	90.00	90.00	70.00	100.00	127.50	150.00
8	160.00	160.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.08	$0.10	.....	$.088	$0.12	.....
4	.....	.08	.10	$0.10	.088	.15	$0.15
5	.....	.11	.135	.....	.121	.18	.18
6	$0.24	.11	.21	.14	.121	.21	.21
8	.43	.18	.315	.225	.198	.30	.325
10	.50	.252	.45	.315	.315	.42	.476
12	.65	.324	.54	.405†	.405	.56	.612
15	1.08†	.432	.75	.675†	.54	.92	1.02
18	1.58†	.60	.90	.945†	1.00	1.32	1.53
20	1.89†	.72	1.20	.....	1.20	.....	.....
21	.....	.84	1.25	1.26†	1.40	.....	.....
22	2.52†	.96	1.35	.....	1.60	.....	1.564
24	2.84†	1.08	2.665	1.62†	1.80	2.16	2.04
27	4.65†	2.405	2.952	2.45†	2.75	3.00	3.34
30	5.16†	2.664	3.96	3.00†	3.75	3.60	4.06
33	6.98†	3.60	4.51	3.55†	4.50	.....	4.99
36	8.00†	4.10	5.06	3.95†	5.00	.....	5.42

	3	5	8	12	24	36
Boston	$0.12	*$0.175*	*$0.25*	$0.50	$1.90†	$5.20†
Minneapolis	.....	.....	.25	.45	1.50	4.56
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.14	.....	.35	.63	2.52	.....
Los Angeles	.1675	.186	.2825	.504	1.74	.....
New Orleans	.205	.40	2.27	3.50	.....	.....
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	.10*	.15*	.25	.425	1.625	.....
Montreal	.....	.50	.70	1.35	4.50	.....
Detroit	.111	.1665	.259	.4995	1.665†	3.7925†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15	.21	.29	.52†	1.90†	3.80†
Philadelphia	.11	.16	.26	.42	1.50	3.70

*4-in., 6-in., 9-in., respectively. †Double Strength.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

		Feb. 3	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065 @$0.075	$0.065 @$0.07
New York, 65% asphalt	(at terminal)	.0675@.0725	.0675@.0725
New York, binder	(at terminal)	.07 @.075	.07 @.075
New York, flux	(at terminal)	.07 @.075	.07 @.075
New York, liquid asphalt	(at terminal)	.07 @.075	.07 @.075
St. Louis, 40@50% asphalt		.0503	.0575
St. Louis, 50@60% asphalt		.0523	.0575
Birmingham, 55% asphalt		.0475	.0475
Dallas, 45% asphalt		.0495	.0495
Dallas, 50% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		12.00*	12.00*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Texas*)	$24.50	.....
Boston (*Mexican*)	**23.50**	**$19.00**
Chicago (*Texas*)	28.00	23.00
SanlFrancisco, *f.o.b. refinery*, Oleum, Cal.	18.00	12.00
Dallas (*Texas*)	27.10	21.10
Seattle, *"D" grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	.....
Minneapolis, *f.o.b. Twin Cities (Standolind)*	**28.10**	**22.10**
St. Louis (*Mexican*)	27.00	24.00
Baltimore (*Standard Oil*) (*f.o.b. refinery*)	22.50	18.50
Montreal (*Imperial*)	27.00	22.50
Atlanta (*Mexican*)	**24.40**	**20.40**
Detroit (*Mexican*)	22.25	18.50
Cincinnati (*Kentucky Rock*)	.....	11.65
Maurer, N. J. (*Bermudez*)	30.00	.....
Maurer, N. J. (*Trinidad*)	23.00	.....
Philadelphia (*Mexican*)	20.00	18.00
Kansas City, Mo. (*Texas*)	28.30	23.30
Los Angeles (*"D" grade, California*)	*18.00	*12.00
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	20.00	17.00

* F.o.b. El Segundo Refinery. Drums used in New York.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$142.40 per M.
San Francisco	Basalt block 4x7x8	70.00 per M.
Chicago	about 5x8x5 dressed	3.60 per sq.yd
	about 5x8x5 common	3.25 per sq.yd.
Boston	5-in. Granite	135.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	2.75 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	Granite, 4x8x4	1.65 per sq.yd.
Kansas City	Granite	4.00 per sq.yd.
Philadelphia	Granite	3.90@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	.24 per sq.ft.
	Queens, 5 ft. wide	.26 per sq.ft.
	6x24-in. cross-walk	1.30 per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis*: Class "A" straight, delivered, 5x18 in., **$1.05** per lin.ft.; roundings, **$1.50**. *Birmingham*: Limestone, 5x18-in., $1.05 per lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.40
New York	3½	16	2.70
Boston	3½	18	2.40
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	**2.45**
St. Louis	4	16	**2.80**
Seattle	4	16	Off market
Minneapolis	3½	16	*2.20*
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	.....
Cincinnati	3½	16	2.35
Kansas City	4	16	2.50
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor, f.o.b., per cu.yd., is as follows:

	Gravel 1½ In. Feb. 3	Gravel 1½ In. One Year Ago	Gravel ¾ In. Feb. 3	Gravel ¾ In. One Year Ago	Sand Feb. 3	Sand One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	1.85	1.65	1.85	1.65	1.56	1.58
St. Louis	1.45	1.45	1.45–**1.65**	1.45	*.83*‡	1.00
Seattle	1.25	1.50	1.25	1.50	1.25	1.50
Dallas	2.38*	2.38	2.38*	2.38	2.00*	2.00
Minneapolis	1.65‡	1.65‡	1.65‡	1.65‡	1.25*	1.25
Cincinnati	1.30†	1.40†	1.30†	1.40†	1.05†	1.35†
San Francisco	1.80	2.15	1.80	2.15	1.40	1.50
Boston (*on trucks at dock*)	1.75†	1.50†	1.75†	1.50†	1.25†	1.00†
New Orleans	2.10†*	2.60	3.00†*	2.60	1.80†	1.75
Los Angeles	1.95†	1.15†	1.95†	1.15†	1.70†	.97½†
Atlanta	1.90†	1.90†	1.90†	1.90†	*1.30*†	1.50†
Detroit	1.70	2.02	1.60	2.02	1.35	1.62
Baltimore	1.40	1.40	1.60	1.60	.70‡	.70‡†
Montreal	1.50†	1.25†	1.50†	1.25†	1.25†	1.25†
Birmingham	2.00*	2.00	2.00*	2.00	1.50	1.50
Philadelphia	2.25*	2.10	2.25*	2.10	1.65	1.50
Kansas City, Mo.	....	....	....	....	.66††	.66‡†
Pittsburgh	.85‡	.....	85‡	....	....	....

•Delivered † Per ton ‡ At pit.

CRUSHED STONE—Price for cargo or carload lots, per cu.yd. f.o.b. city, as follows:

	1½ In. Feb. 3	1½ In. One Year Ago	¾ In. Feb. 3	¾ In. One Year Ago
New York	$1.84	$1.75	$1.94	$1.85
Chicago	1.70	1.75	1.87½	1.87½
St. Louis	1.93*	1.93*	1.93*	1.93*
Dallas	2.40†	2.40	2.83†	2.83
San Francisco	1.70	2.15	1.70	2.15
Boston (*on trucks at dock*)	2.10*	1.60*	2.10*	1.60*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	2.00†	1.50	2.00†	1.50
Denver	2.50†	2.50	2.50†	2.50
Seattle	3.00†	3.00	3.00†	3.00
Atlanta	2.50*†	2.50*	2.50*†	2.50*
Cincinnati	1.65*	1.90*	1.65*	1.90*
Los Angeles	2.10*†	1.40*	2.10*†	1.40*
Detroit	2.60*†	2.00*	2.60*†	2.00*
Baltimore	2.50†	2.50	2.55†	2.55
Montreal	1.80*	1.80*	2.00*†	1.50
Philadelphia	2.25†	2.10	2.25†	2.10
Pittsburgh	2.75†	2.85	2.75†	2.85
Cleveland	2.70*†	3.25*	2.70*†	3.25*
Birmingham	2.00†	2.00	2.00†	2.00

* Per ton. † Delivered.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plant

	1½-In	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Buffalo District	1.25	1.35	2.25	1.25
Birmingham, Ala	.90	1.25	2.05	.80
Cleveland, Ohio	1.70*	1.70*	....	1.40*
Eastern Pa. and Northern N. J.	1.25	1.25	2.00	1.25
Western Pennsylvania	1.25	1.25	2.00	1.25
Toledo, Ohio	1.25	1.25	1.50	1.25

*Includes freight charge.

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$11.00	$3.50*	$2.10@3.00*
Chicago	20.00	18.00	.....	1.50†
St. Louis	23.50	*17.50*	.....	2.03*
Boston	18.35	11.50	3.55*	2.50@3.00
Dallas	19.00	.....	.....	1.82†
Cincinnati	16.80	11.90	.....	11.40‡
San Francisco	25.50	22.00	.....	1.60†
Minneapolis	25.50	21.00	.....	1.70†
Denver	24.00	.....	.....	2.70*
Detroit	15.25	11.25	.....	11.75‡
Seattle, *paper sacks*	24.00	.....	2.80†	.....
Los Angeles	25.00	15.00	3.50*	19.00‡
Baltimore	24.25	.....	2.55†	.....
Montreal	.....	21.00	.....	10.00‡
Atlanta	22.00	13.00	.....	14.00‡
New Orleans	24.00	15.00	2.60†	2.25*
Philadelphia	23.00	16.00	.....	.....
Kansas City	18.50	17.50	2.45†	2.10*
Birmingham	22.50	16.00	2.40†	1.85†

* Per 280-lb. bbl. (net). † Per 180-lb. (net). ‡ Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	Feb. 3	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.45	1.35
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.75	2.65
St. Louis (Carney)	2.35	2.35
Birmingham (Magnolia) pozzolan cement	2.40	2.40

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Feb. 3	One Month Ago	One Year Ago
New York, del. by truck	$2.35@$2.50	$2.50@$2.60	$2.50@$2.70
New York, alongside dock to dealers	*2.03*	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.35	2.35	2.40
Chicago	*2.05*	2.10	2.10
Pittsburgh	*2.04*	2.09	2.09
Cleveland	*2.24*	2.29	2.29
Detroit	2.15	2.15	2.15
Indianapolis	*2.19*	2.29	2.29
Milwaukee	*2.20*	2.25	2.25
Duluth	*2.04*	2.09	2.09
Peoria	*2.22*	2.27	2.27
Cedar Rapids	2.24	2.24	2.34
Davenport	*2.24*	2.29	2.29
St. Louis	*2.05*@2.20	2.20	2.20
San Francisco	2.31	2.31	2.31
New Orleans	2.40	2.40	2.40
Minneapolis	2.22	2.22	2.32
Denver	2.85	2.85	2.84
Seattle	2.65	2.65	2.65
Dallas	2.05	2.05	2.05
Atlanta	*2.25*	2.35	2.35
Cincinnati	*2.32*	2.37	2.37
Los Angeles	2.50	2.50	2.52
Baltimore	2.50	2.50	2.50
Birmingham	*2.30*	2.40	2.40
Kansas City, Mo	2.05	2.05	2.02
Montreal	1.15	1.15	1.80
Philadelphia	2.50	2.50	2.60
St. Paul	2.22	2.22	2.32
Toledo	2.20	2.20	2.20

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind	*$1.80*	Hudson, N. Y.	*$1.75*
Universal, Pa	*1.80*	Leeds, Ala	*1.85*
Steelton, Minn	*1.85*	Hannibal, Mo	1.95
Fordwick, Va	2.05	Lehigh Valley District	*1.75*
Mitchell, Ind	*1.90*	Wyandotte, Mich	1.90
Iola, Kan	1.85	Alpena, Mich	1.75
Mason City, Ia	1.80	Kingsport, Tenn	2.03
La Salle, Ill	*1.90*		

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots at mills; from warehouse in less-than-carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.99	$1.01	$1.39	$1.06	$1.13	$1.22
049	28	1.26	1.29	1.76	1.35	1.38	1.55
068	35	1.54	1.58	2.16	1.66	1.67	1.91
093	45	1.98	2.03	2.77	2.13	2.00	2.46
126	57	2.45	2.51	3.45	2.63	2.55	3.03
153	68	2.92	2.99	4.11	3.14	3.15	....
180	78	3.35	3.43	5.70	3.60	3.47	....
245	103	4.43	4.53	6.21	4.75	4.58	....
287	119	5.12	5.24	7.19	5.50	5.26	6.35
336	138	5.93	6.07	8.35	6.37	6.11	....
395	160	6.88	7.04	9.65	7.38	7.12	....
		PAVING					
036P	17	$0.76	$0.77	$1.06	$0.81	$0.76	....
053P	24	1.07	1.09	1.50	1.14	1.07	....
072P	31	1.35	1.38	1.90	1.45	1.39	....
097P	40	1.74	1.78	2.45	1.87	1.90	....
049R	24	1.07	1.09	....	1.14	1.02	....
067R	31	1.35	1.38	....	1.45	1.39	....
089R	40	1.74	1.78	....	1.87	1.90	....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in less-than-carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	Chicago	St. Louis	San Francisco	Dallas
2.2	$17.50	$19.50	$17.50	$16.50	$19.00	$24.00
2.5	18.50	21.50	18.50	17.50	21.00	26.00
3.0	21.00	24.50	21.00	20.00	24.00	29.00
3.4	22.50	27.50	22.50	21.50	26.00	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb., in carload lots, f.o.b., except at New York and St. Louis warehouses:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	*$1.90*@	$2.00	$2.25	$3.24	$2.30@$2.50	$3.15	$2.75	$2.95
⅝	*2.00*@	2.10	2.35	3.34	2.40@ 2.60	3.25	2.85	3.05
¾	*2.10*@	2.20	2.45	3.44	2.50@ 2.70	3.35	2.95	3.15
⅞	*2.30*@	2.40	2.65	3.64	2.70@ 2.90	3.55	3.10	3.35
1	*2.90*@	3.00	3.25	4.24	3.30@ 3.50	4.15	3.75	3.95

For standard classification of extras for size and cutting of steel bars, see bar card of July 15, 1923.

ROLLED FROM RAILS

	Warehouse: St. Louis	Dallas		St. Louis	Dallas
½ in and larger	$2.35	$2.48	½	$2.75	$2.88
⅝	2.45	2.58	¾	3.35	3.48
¾	2.55	2.68		....	....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Feb. 3	Common: One Month Ago	Common: One Year Ago	Paving Block: 3-inch*	Paving Block: 3½-inch*
New York (del.)	$20.40–22.40	$20.40–22.40	$20.40	$45.00†	$51.00†
New York (at dock)	17.00	17.00	17.00	....	....
Chicago	12.00	12.00	12.00	42.00	45.00
St. Louis, salmon (del.)	15.00	15.00	16.00	40.00	42.50
Denver, salmon	9@10	9@10	12.00	....	....
Dallas	14.10	14.10	10.50	35.00	....
San Francisco	15.00	15.00	15.50	....	....
Los Angeles	*10.50*	11.00	11.50	(not used)	
Boston (del.)	19.50	19.50	17.50	45.00	50.00
Minneapolis (del.)	13.75	13.75	13.50	....	....
Kansas City	13.50	13.50	14.50	(no market)	
Seattle	15.00	15.00	15.00	....	55.00
Cincinnati	15.50	15.50	17.00	40.00	45.00
Montreal	20.25	20.25	17.50	100.00‡	....
Detroit (del.)	16.00	16.00	16.00	38.40	41.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	12.00	12.00	10.50	40.00	....
New Orleans	15.00	15.00	15.00	60.00	75.00
Birmingham	14.50	14.50	12.50	40.00	45.00
Philadelphia	18.00	18.00	17@20	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	....	....
Cleveland	12@14	12@14	14.00	....	....

*For paving blocks 3x8½x4 and 3½x8½x4 respectively. †In cars. ‡Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Feb. 3 on Trucks*†	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1027	$0.1112	$0.076	$0.105	$0.068	$0.108	.....
6x12x12	.1541	.1667	.104	....	.09	.156	.....
8x12x12	.1926	.2084	.142	.205	.126	.244	.....
10x12x12	.....	....	.182	.....	.158	.....	$0.252
12x12x12	.....	....	.202	.....	.188	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.08	$0.165	$0.27
Minneapolis (f.o.b. cars)	.068	.1175	.205
Minneapolis (delivered)	.076	.13	.225
Cincinnati	.064	.1295	.1726
Kansas City	.088	.154	.252
Denver	.075	.155	.188
Seattle	.09	.18	.26
Los Angeles	.085	.172	....
New Orleans	.11	.205	.31
Detroit	.0707	.1326	.1853
Montreal	.10	....	.....
Baltimore	.124	.268	.....
Atlanta	.0895	.1837	.....
Dallas	.112	.19	.31
Birmingham	.11	.124	.255
Pittsburgh	.068	.128	.179
Cleveland	.062	.12	.....

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carload lots, f.o.b. mill, Pittsburgh and Birmingham, together with quotations in less-than-carload lots from warehouses at places named:

	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	*$1.90*@$2.00	$2.05	$3.34	$4.15	$3.25	$3.10	*$3.00*
Channels, 3 to 15 in.	*1.90*@ 2.00	2.10	3.34	4.15	3.25	3.10	*3.00*
Angles, 3 to 16 in., ¼ in. thick	*1.90*@ 2.00	2.10	3.34	4.15	3.25	3.10	*3.00*
Tees, 3 in. and larger	*1.90*@ 2.00	2.10	3.34	4.15	3.35	3.10	*3.00*
Plates, ¼ in. thick and heavier	1.90	2.00	3.34	4.15	3.25	3.10	*3.00*

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York, Feb. 3	New York, One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	*$2.30*@$2.60	$4.20	$4.50	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	2.90	$4.40	$4.70	$3.70	$3.85	$5.20	$5.00
⅝ and ¾	3.05	4.55	4.85	3.80	4.20@4.45	5.35	5.15
⅞ and 1	3.30	4.80	5.10	4.05	4.60	5.60	5.50

NAILS—The following quotations are per 100 lb. keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$2.85	$3.05	$3.50	$4.25	$2.85	$4.95
Cut	2.80	2.90	....	*5.00*	5.00	3.00	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½	$7.50	$5.75	$7.75
⅝	7.05	5.30	5.65
¾	6.90	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (4 ply) in rolls of 108 sq.ft costs $2.46 per roll to contractors in carload lots f.o.b. New York.

Single shingles, slate finish, cost $6.36 per square (sufficient to cover 100 sq.ft.) in carload lots, f.o.b. New York. Strip shingles (4 in. 1) f.o.b. New York, in carload lots to contractors, $5.00 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to contractors in carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$72.00
Asphalt coating, per gal	.33
Asphalt felt, per 100 lb	3.71

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 83 per cent; "A," 87 per cent; "B," 89 per cent. Double thickness "AA," 82 per cent; "A," 86 per cent; "B," 89 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	*$2.20*@*2.30*	$3.60	$3.50	*$3.75*	$3.89
No. 12	*2.25*@*2.35*	3.65	3.55	*3.80*	3.94
No. 14	*2.30*@*2.40*	3.70	3.60	*3.85*	3.99
No. 16	*2.40*@*2.50*	3.80	3.70	*3.95*	4.09
Black					
Nos. 18 to 20	*$2.70*@*2.80*	4.25	3.75	*4.50*	4.15
No. 22	*2.85*@*2.95*	4.40	3.90	*4.65*	4.30
No. 24	*2.90*@*3.00*	4.45	3.95	*4.70*	4.35
No. 26	*3.00*@*3.10*	4.55	4.05	*4.80*	4.45
No. 28	*3.15*@*3.25*	4.70	4.20	*4.90*	4.60
Galvanized					
No. 10	*$3.05*@3.15	4.55	4.10	*4.55*	4.40
Nos. 12 to 14	*3.15*@3.25	4.65	4.20	*4.65*	4.50
No. 16	*3.25*@3.35	4.75	4.30	*4.75*	4.60
No. 18	*3.40*@3.50	4.90	4.45	*4.90*	4.75
No. 20	*3.55*@3.65	5.05	4.60	*5.05*	4.90
No. 22	*3.60*@3.70	5.10	4.65	*5.10*	4.95
No. 24	*3.75*@3.85	5.25	4.80	*5.25*	5.10
No. 26	*4.00*@4.10	5.50	5.05	*5.50*	5.35
No. 28	*4.25*@4.35	5.75	5.30	*5.75*	5.60

For galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per 7½-lb. gallon:

	New York: Feb. 3	New York: One Year Ago	Chicago: Feb. 3	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	$0.84½	$0.88½	$0.87	$0.90

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	Feb. 3	1 Yr. Ago	Feb. 3	1 Yr. Ago
Red	$15.25	$15.25	$16.75	$16.75
White	15.25	15.25	15.25	15.25

Lumber

Prices wholesale, per M. ft. b.m., to contractors in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to contractors at yards.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00	$30.00	$32.00
6x14	34.00	36.00	38.00
8x10	28.00	30.00	32.00
8x14	34.00	36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York		Chicago	
	20 Ft. and Under L.L.Y.P.	22-24 Ft. L.L.Y.P.	20 Ft. and Under No.1 L.L.Y.P.	Up to 32 Ft. No.1 Douglas Fir
3x4 to 8x8	$42.00@$44.00	$43.00@$45.00	$39.00	$40.00
3x10 to 10x10	49.00@ 51.00	50.00@ 52.00	46.00	40.00
3x12 to 12x12	56.00@ 58.00	57.00@ 59.00	56.00	40.00
3x14 to 14x14	64.00@ 66.00	65.00@ 67.00	.....	40.00
3x16 to 16x16	76.00@ 78.00	77.00@ 79.00	.....	41.50

New York—Wholesale price of long-leaf yellow pine timbers (rough) to dealers; to contractors, delivered from lighters or cars to job, $5@$10 additional. Short-leaf pine costs $3 per M. ft. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 32 ft. and $1 for each additional foot from 32 to 36 ft.

Other Cities	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$48.50	$48.00†	$50.00	$51.00	$58.50	$58.00†
Seattle	.....	24.00	.....	.....	.....	25.00
New Orleans	36.00	.....	.....	.....	43.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	55.00	.....	.....	60.00	65.00
Los Angeles	.....	33.00	.....	.....	.....	33.00
Denver	.....	33.75	32.75	32.75	.....	32.75
Minneapolis	42.50	39.25	34.50	.....	45.00	39.25
Atlanta	31.00	.....	.....	.....	34.00	.....
Dallas	56.00	.....	.....	.....	56.00	.....
Kansas City, Mo.	42.50	40.75	.....	.....	57.50	40.75
Birmingham	32.00	.....	.....	.....	34.00	.....
Philadelphia	54.00	38.00	38.00	45.00	65.00	38.00
Detroit	47.75	46.75	.....	.....	61.75	46.75
St. Louis	41.00	.....	.....	.....	53.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$44.50	$42.00†	$45.00	$49.00	$48.00†
Seattle	.....	22.00	.....	.....	23.50
New Orleans	38.00	46.00	.....	28.00	34.00
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	45.00	50.00	40.00	65.00	50.00
Los Angeles	.....	27.00	.....	.....	36.00
Denver	.....	32.75	33.25	.....	30.25
Minneapolis	42.50	35.75	34.75	36.00	33.75
Atlanta	22.00	.....	.....	28.00	.....
Dallas	52.25	.....	.....	56.00	.....
Kansas City, Mo.	50.25	40.75	.....	40.00	35.75
Birmingham	27.00	.....	.....	45.00	.....
Philadelphia	30.00	38.00	36.00	35.00	37.00
Detroit	39.75	37.00	.....	46.50	41.25
St. Louis	43.00	.....	.....	29.00	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M.ft. additional.

*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York:

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Feb. 3	One Month Ago	One Year Ago
$2.25@$2.30	$2.25@$2.30	$2.25@$2.30

CONCRETE BLOCKS—Standard 8x8x16-in., delivered to job, each:

Denver	$0.22	St. Louis	$0.18*
Detroit	.16	Boston	.21
New Orleans	.25*	Minneapolis	.15*
New York (Brooklyn)	.18@.20	Philadelphia	.18@.20
Pittsburgh	.18		

*F.o.b.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ½-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft.; ¾-in., 6; ⅞-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

Boston	$0.22	New Orleans	$0.21
New York	.24½	Los Angeles	.25
Chicago	.23	Seattle	.22
Minneapolis	.25	St. Louis	.24
San Francisco	.22½	Montreal	.17
Atlanta	.30	Detroit	.24½
Denver	.24@.25	Baltimore	.18
Cincinnati	.21	Kansas City	.29
Dallas	.31	Birmingham	.26@.27
Philadelphia	.25		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265*	$0.2875*
Boston	.245	.265
Kansas City	.2025	.2225
Seattle	.165	.19
Chicago	.195†	.2175†
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.306
Los Angeles	.1875	.2225
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.1675	.1875
Birmingham	.22	.24
New Orleans	.235	.26
San Francisco	.1625	.1925
Philadelphia	.215	.24

*Special gelatin in case lots. †Quantities above 500 lb. and less than a ton.

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb.	$2.00@$2.10
Sulphate of copper, in bbl., per 100 lb.	4.80@4.90
Soda ash, 58%, in bags, per 100 lb.	1.32½@1.37½
Chlorine, liquid, tanks, per lb.	.04@.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.00@2.10

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Atlanta	$0.58	Detroit	$0.29
Baltimore	.31	Kansas City	.735
Birmingham	.58	New Orleans	.67
Boston	.365	New York	.34
Buffalo	.265	Pacific Coast (all rail)	1.15*
Chicago	.34	Philadelphia	.32
Cincinnati	.29	St. Louis	.43
Cleveland	.19	St. Paul	.60
Denver	1.15*		

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.